Telephone Engineer

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Telephone Man May Lead Country to Prosperity A telephone man has been hailed as the saviour of the day. Walter S. Gifford, president of the American Telephone and Telegraph Company, recently named by President Hoover to head a national organization in charge of relief for unemployment during the approaching winter, is this man.

The task assigned to Mr. Gifford is a gigantic one, considered by some to be well-nigh an impossible one. However, it is the sentiment of the country in general that a more able man for this big job could not be found, and that if any one person could conceive of a plan by which unemployment and the subsequent human suffering could be relieved, that man is Walter S. Gifford.

Mr. Gifford has been told to use his own judgment as to the kind of organization to be set up by him in Washington and the methods to be employed. The purpose of the organization will be "to cooperate with the public authorities and reinforce the national, state, and local agencies which will have responsibilities for the relief activities." Mr. Hoover has pledged Mr. Gifford "the whole force of the administration" in carrying out the task. This shows the faith of the United States Government in a telephone man's ability to achieve the solution to a problem which is world-wide in scope, for in most of the countries abroad unemployment is as wide-spread, or more so, than it is in this country. England has been smug about her "dole" system. But the dole increased to such proportions that recently the country was nearly bankrupt. Now England is willing to find a substitute method for relieving unemployment. Mr. Gifford is expected to conceive of a far better plan than the dole. Through Mr. Gifford's initiative, it might easily happen that the United States should show the world the way back to prosperity.

No better man for the new position could have been selected than Mr. Gifford. He was appointed after several conferences between the President and Mr. Gifford. His ability has long been recognized and his services have been placed at the disposal of the nation in time of stress.

At the request of President Wilson, Mr. Gifford made a survey of industrial preparedness before the war was declared, and afterward Secretary Newton D. Baker of the War Department named him head of the National Defense Council, which mobilized the country's industries into war units. He has played an active part in unemployment relief since the depression started in the autumn of 1929 and was among the industrial leaders whom Mr. Hoover called to Washington for a conference in December of last year. He was an active worker on the committee organized by Seward Prosser for emergency relief in New York City and was one of the first to recognize the need for relief measures.

It is typical of Mr. Gifford that he made no broad predictions and accepted the new duty as calmly and modestly as though it had been a social club membership instead of an obligation to meet a tremendous national emergency.

Gifford's mind strikes through to the crux of a problem almost automatically. That is why he went through Harvard in three years. That is why in the twenty-one years between 1904 and 1925 he rose from the place of a clerk who was hardly more than an office boy in the Western Electric Company in Chicago to the presidency of the American Telephone and Telegraph Company.

Besides concentrating upon telephone puzzles, he studies abstractions. He reads economics and sociology. He enters upon this winter's emergency task with an executive's practicality, a telephone man's understanding of people, and a student's knowledge of the immense ramifications of the problem of millions out of work.

More About Rural Telephones Independent telephony was born and reared in the country. The Independent telephone movement today owes its existence almost entirely to the fact that, from the beginning, it was able to furnish a popular service at a popular price. Wherever these principles have been adhered to, the business has gone steadily forward and is today on a sound basis. Large numbers of these smaller exchanges have fallen into the hands of speculators.

What is the remedy in such cases? Frankly, we do not know. We would not recommend an extended credit system, for we do not believe any such system would be a success except in the hands of an individual owner of the property. Losses in stations can not be made up by increasing the rates to those that remain. Some have tried to regain the loss in stations through an intensive sales campaign with results that have only been partly satisfactory.

The personal touch of private ownership and a collection plan that is more or less flexible as to manner and kind of payment will help to tide many a telephone plant over the rough spots and at the same time preserve the subscribers' list practically unbroken to those who are in position to pay promptly, and will do so for the more extended service.

The development of rural telephone business in the early day was based on the neighborhood party-line, having all the way from twelve to thirty-six telephones on a line. When people living in a certain community showed an interest in telephone service, the owner of the plant would state that if enough subscribers could be secured to average two to the mile, the service would be installed. Therefore, the number on the line was determined largely by the distance from the exchange center to the community served. This group method of development accounted for the rapid growth of nearly all privately owned plants, and losses of rural telephones in groups has accounted for much of the station loss recorded in the smaller exchanges in the last two years. There is no call for the owners of the smaller telephone exchanges to enter the field of philanthropy on a large scale but if the business is to be preserved, it is going to be necessary to formulate a policy that will place a telephone in practically every farm home in the exchange area and see that it remains there. The service to the community is then so valuable that no other agency can take its place.

Others have been purchased by the larger groups of Independent companies that have succeeded in placing their business on a sound financial structure. The rural situation has not proved satisfactory to either class of investors.

In the first place, the two forms of telephone management—individual and corporation—are widely different. The individual owner's investment is based on a minimum of cost per station, with no overhead, and his construction program proceeds according to the demand for service. He knows his subscribers and is known by them. He studies their telephone needs and supplies them. They are appreciative of the service rendered and when the monthly bill falls due, he does not need to spend any time wondering how many stations will have to be removed because of non-payment. It is true, they do not always have the ready cash but that is arranged satisfactorily. Many of them pay in butter, eggs or poultry. Some of the most successful small exchange owners have become expert dealers in products of the farm, and have therefore been able to clear their books at least once a year, regardless of business conditions.

The history of the Independent telephone business records the names of many men who, from the most humble start, have developed their holdings to a point where they were worth many thousands of dollars. When they reached the time in life when they wanted to be relieved of the burdens and responsibilities of the telephone business, ready purchasers were found at satisfactory prices.

But where these properties have fallen into the hands of larger companies with fixed operating practices and a big overhead, it has often spelled ruin to the rural part of the business. The personal feeling on the part of the subscribers, that comes from private ownership, is soon lost. This is noticeable first of all among the rural patrons of the company, where strict collection rules have been unknown. A break in the ranks is soon noted. A few telephones are taken out at first and others follow. By the end of a year, the rural service that had done so much in building up the patronage in town has dwindled away until its value to those who remain is negligible, and other stations are removed because the subscribers are unable to reach the country folks.

Sunset or Sunrise, Which?

We know of a couple, who, for many years have made it a practice to drive into the country on summer evenings to view the sunsets. From the tops of the hills surrounding the city in which they live, they have feasted their souls on the beauties as displayed near the close of day, when thunder clouds hovering near the horizon, have helped to create scenes of glory that no artist's brush has ever been able to copy. Recently they made a new discovery. With some friends they planned a fishing trip that called for an early start. As the sun made its appearance in the East, attended by broken clouds, the rear-guard of a thunder shower that had passed over a short time before, they were permitted to behold a scene that, in grandeur and beauty, exceeded the most gorgeous sunset they had ever witnessed. Now we find them out in the early mornings, searching for even greater riches than those contained in the most beautiful sunset.

We are wondering if it is not so with many of us in the business world. Instead of looking for the sunrise that is just as sure as there is a God in heaven, we are dwelling upon the prosperity of a day that is past and gone, unmindful of the world's great store-house of material things that must be unlocked to industry at no very distant day.

Uses of "B" Position Tripping Jack Circuit

How Trip Relay Is Necessary for Tripping "A" Office Machine Ringing Cord Circuit Is Explained in This Article by John H. Levis, Jr., Telephone Engineer, Rochester, N. Y., in the Fourteenth Article of His Series on the Subject of Straightforward Trunking

When the incoming straight forward trunk circuit is connected to an "A" office which has "A" cord circuits with machine ringing facilities, it is necessary to equip each incoming "B" position with a time element circuit so that the "B" operator can trip the distant "A" office ringing circuit.

The "A" operator plugs the front cord of a cord circuit into the outgoing trunk to the distant office and the number one relay of the trunk operates. This in turn operates the number three relay, which starts the sequence control circuit to cut the "B" operator's circuit to the trunk, call passing tone and the other functions of the trunk circuit which have been previously described in TELEPHONE ENGINEER. After the "A" operator has passed the order to the "B" operator, the "A" operator depresses a start ringing key in the cord circuit connected to the trunk circuit instead of operating the operator's circuit release key. This condition places generator on the trunk conductors and causes the generator to be heard in the "B" operator's head telephone. The generator also causes the number one relay of the trunk to flutter, but this condition will not release the trunk selection because the number three relay which controls the trunk is of the slow release type.

Trip Relay Releases Generator

When a trunk has the "A" office ringing generator on it the "B" operator either picks up the trunk plug or removes it from a line jack and places the trunk plug into the tripping jack circuit. This at once places a momentary closed circuit across the trunk plug talking circuit which causes the number two relay to operate, shorting out the Hi winding of the Hi Lo relay number one and placing the Lo winding across the trunk conductors on which is the "A" office generator tripping circuit. This causes the trip relay to function momentarily, thereby releasing the generator and placing the "A" cord circuit in a talking condition.

Plugging the "B" trunk into a jack does not in any way interfere with the trunk circuit operation because no preselect of the ringing at the "B" end is made. After the "B" operator has tripped the "A" office ringing circuit, the "B" trunk pre-select is made and the trunk is handled in the standard manner.

At times during the busy hour, from some "A" offices, the "A" operator will plug into the outgoing trunk jack circuit and operate the ringing key at once. The ringing key that is operated is the one that has been given to the "A" operator by the calling station, but is the one to be passed for the "B" operator to select on the trunk. In this case the "B" trunk comes in ringing, that is, the "B" operator does not get an order but instead gets ringing current at the time of cut-in.

The "B" operator then places the ringing trunk into the tripping jack circuit, trips the "A" office generator circuit and obtains the order of the distant office calling station direct and then proceeds in the usual manner in handling the trunk circuit.

Time Element of Loop Closing

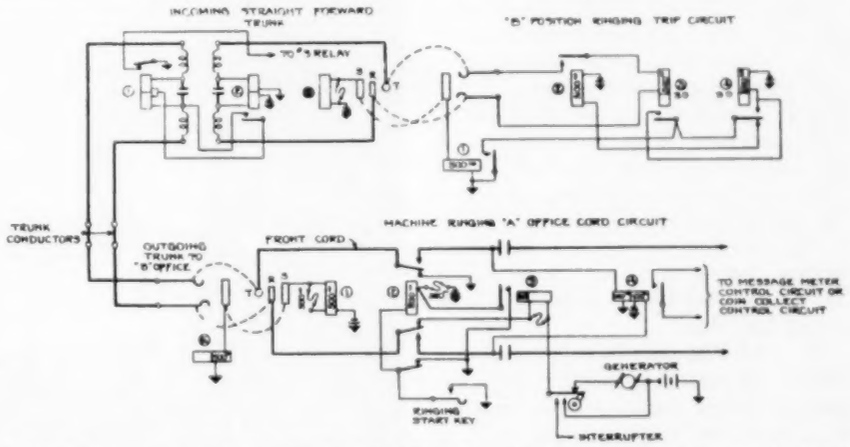
The tripping jack circuit is used by the "B" operator at times for tripping a trunk circuit upon which a wrong ringing selection is made. In this case, the removal of the trunk plug from the tripping jack makes it necessary for the trunk to cut-in again before any further ringing selection can be made. This feature has been described in a previous issue of TELEPHONE ENGINEER under the heading "Trunk Calls to Intercepting Desk."

The tripping circuit must have a certain time element of loop closing because many "A" office cord circuits have automatic coin collecting circuits and automatic line message meter circuits. With these features it is obvious that only the generator should be tripped and that the talking battery supply relay, which controls the above features under the ringing trunk conditions, should not operate.

The circuit diagram shows a partial "A" office machine ringing cord circuit, outgoing trunk circuit, "B" trunk circuit (only that portion involved in tripping back) and the "B" position ringing trip circuit. The back cord of the "A" cord circuit has been omitted for simplicity. The "A" operator plugs the front cord into the outgoing trunk jack and at once depresses the ringing start key which locks up the No. 2 relay, which cuts off the talking circuit and places the "A" cord circuit generator and trip relay No. 3 onto the trunk circuit conductors. This operates the Nos. 1 and 3 relays of the trunk circuit and operates the operator's cut in circuit. It also places generator in the operator's head telephone. The "B" trunk plug is placed in the "B" position ringing trip circuit which operates as follows:

Functions of Various Relays

The No. 8 relay of the trunk plug causes the number one relay to operate,



Circuit diagram showing method of tripping "A office" machine ringing cord circuit through "B" straightforward trunk circuit.

causing the No. 2 to operate through the back contact of No. 4 relay. With the No. 2 relay operated, the No. 3 relay of 500 ohms is placed across the tip and ring conductors of the trunk plug, causing the battery supply relay No. 2 of the trunk circuit to operate. This, in turn, closes the bridge back control circuit of the Hi-Lo relay No. 1 of the trunk circuit which causes the No. 3 trip relay in the "A" office cord circuit to operate. A short circuit is now placed across the No. 2 relay of the "A" cord circuit, causing it to release, thereby removing the generator from the "B" trunk circuit.

When the No. 3 relay of the ringing trip circuit operates from the battery and ground of relay No. 2 of the "B"

(*Turn to page* 19.)

Our Engineering and Management Course

Super-Service Type of Manual Switchboards, Representing a Distinct Improvement Over the Regular Common Battery Boards Are Described Here by B. C. Burden, Transmission Engineer, Lincoln Telephone and Telegraph Co., in the Eighth Installment of a Course of Instruction.

General

Common battery manual switchboards which are equipped with special cord circuits which speed up service are referred to as "feature boards," or "super-service boards."

Such boards represent a distinct improvement over the regular manual common battery boards, and especially is this true in the larger exchanges.

Special Features

The following list is representative of some of the special features available on "super-service" type boards:

Operator's Bar, Advance Plugging-In, Operator's Secret Service, Instantaneous Ringing Cut-Off, Reverting Ringing Tone, Dark Keyboard, Operators' Ringing Control, Machine Ringing, Flashing Recall, Call Registration.

Operator's Bar

The term "operator's bar" applies to the feature in a super-service type cord circuit, which prevents an operator from going in on either an established connection or from interrupting another operator who may be taking a call.

This feature insures secret service to the subscribers as it is impossible for the operator to listen in without removing one of the plugs which, of course, interrupts the conversation.

The fact that an operator cannot interrupt another operator is also of special advantage with boards employing multipled line lamps.

In order that an operator may know whether or not she is barred from a line, the supervisory light is arranged to light only when her headset is connected to the subscriber's line.

Advance Plugging In

The advance plugging-in feature permits an operator to plug up one call in advance of the completion of the first call.

This arrangement allows her to overlap the plugging-in time on one circuit with the period required to obtain a subscriber's number on a previous call.

This permits faster operating and greater load per operator.

This circuit is so designed that the operator's headset is not connected to the second cord pair until she has disposed of the first connection. Supervisory lights indicate to the operator to which pair of cords her headset is connected.

Operators' Secret Service

A feature which greatly enhances service over super-service type boards is "operators' secret service."

This is an arrangement whereby the operator's headset is prevented from cutting in on an established connection, hence the operator is unable to eavesdrop on subscribers' conversations.

The operator's headset is also removed from a cord circuit the minute ringing starts.

Machine Ringing

Machine ringing whereby the calling subscriber is signalled intermittently until the call is answered or abandoned, is a feature of super-service type boards which relieves the operator, and which results in faster answering on the part of the called subscriber. It is only necessary for the operator to start the ringing by depressing a ringing key.

Call Registration

The amount of traffic handled by the different switchboard positions must be known in connection with traffic load studies. Feature boards are provided with call registration circuits which record the number of completed calls handled on each position. The circuit is so arranged that the meter registers only when the call has been completed as far as the operator is concerned.

Flashing Recall

The flashing recall feature provides means for a calling subscriber to quickly regain the operator's attention by simply depressing the hookswitch once.

This act automatically starts the answering supervisory lamp of the cord circuit in use to flashing rapidly. This may occur either before the called party has answered or after the called party has hung up, provided the calling party plug is inserted in a jack.

A pilot lamp common to the position also flashes on a recall signal. The flashing continues until the operator removes the calling plug from the called line.

Operators' Ringing Control

A feature which greatly simplifies the keyboard equipment and which speeds up operation, is the use of only one set of ringing keys which are common to the entire position.

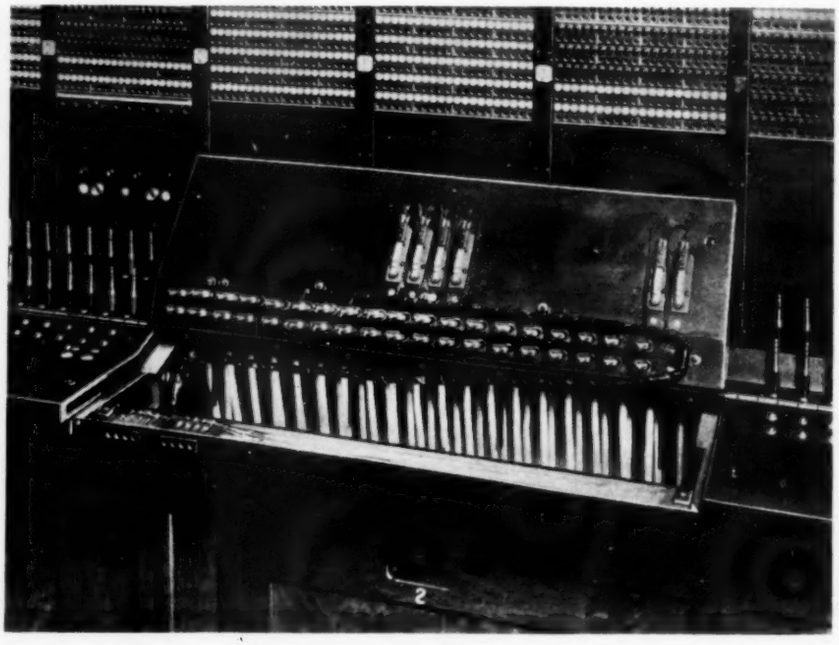


Fig. 1—Close-up view of super-service switchboard with keyboard raised.

The common ringing equipment is associated with any calling cord when it is plugged into a line. It remains in this condition until one of the common ringing keys or a non-ring key is depressed.

Thus when a calling subscriber's connection is set up and one of these buttons is depressed to ring over the called line, the common ringing equipment, as well as the operator's telephone set, is released from the cord pair. Ringing current, however, continues to be impressed upon the line intermittently until the party being called answers, or until the calling party abandons the call. Figure 1 shows the extreme simplicity of the key-

board as a result of this feature.

Instantaneous Ringing Cut-Off

When machine ringing is employed in a central office switchboard, it is necessary that the ringing current be disconnected from the calling cord when a party on the called line removes a receiver from the hookswitch of a called telephone.

In feature cord circuits the ringing is automatically disconnected on either the silent or the ringing periods when the receiver is removed from the hookswitch. The action of cutting off the current is instantaneous, so that it prevents the subscriber from being rung in the ear.

Reverting Ringing Tone

Most feature boards are provided with a circuit arrangement which feeds a weak but distinctive tone back to the calling subscriber each time the called subscriber is signalled.

This tone does away with the usual supervision which results from such questions as "Did you ring my party?" "Will you please ring my party again?" etc.

Dark Keyboard

An arrangement found on some feature boards which simplifies and speeds up the operator's work, is the dark keyboard circuit, which provides for the supervisory lamps of both calling and called cords being extinguished just as soon as an operator starts the machine ringing.

The operator need pay no further attention to the connection as the machine ringing and reverting ringing tone accomplishes the functions requiring an operator's attention on the regular non-feature manual boards.

Feature Board Cord Circuits

The chief difference between feature switchboards and the simpler type boards is in the cord circuits.

Some feature boards while requiring a more complicated cord circuit have keyboards which are extremely simple, and the greater efficiency and higher grade of service that can be rendered by these boards makes them very attractive to the progressive company wishing to offer the best possible grade of telephone service.

Figure 2 shows the circuit diagram of a popular type of feature board. Space does not permit a description of the circuit operation.

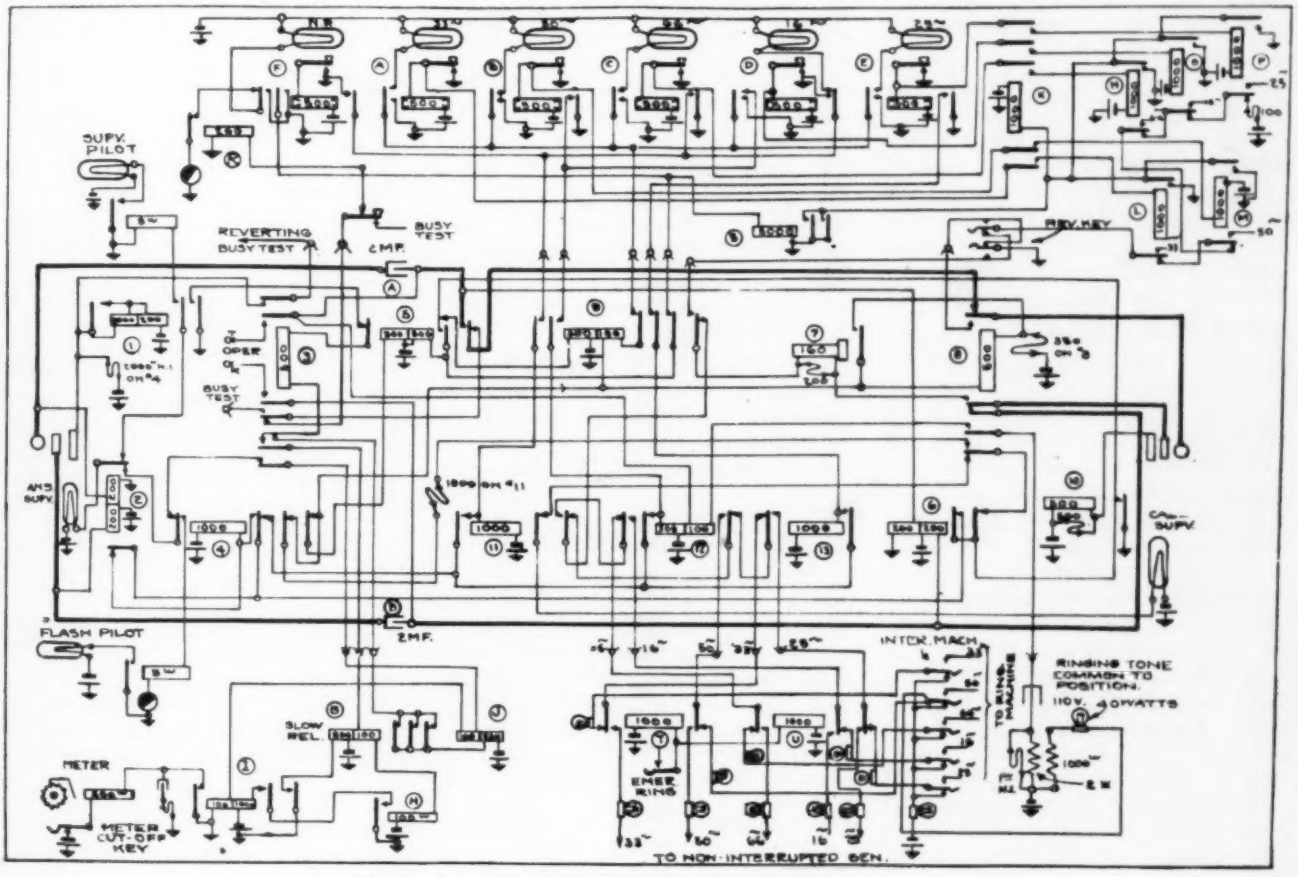


Fig. 2—Cord circuit diagram of special feature switchboard.

USES OF "B" POSITION TRIPPING JACK CIRCUIT

(*Continued from page* 17.)

trunk circuit, it closes its contact with ground from No. 1 relay to the winding of No. 4 relay with battery on it, causing relay No. 4 to operate, opening the operating path of No. 2 relay which closes the loop with the No. 3 relay. With No. 2 relay released the loop is again opened.

The "B" operators are instructed to allow about 3 seconds to elapse before removing the trunk plugs from the tripping jack. This gives the proper time for complete tripping functions.

Relays Nos. 3 and 4 of the tripping circuit are of the slow to operate type. This allows the proper delay or holding time of the No. 3 relay across the loop for proper tripping of the generator circuit before it is finally removed from the loop. After the trip circuit has completed its cycle the only relay to operate is the No. 4 relay. It is locked up from the No. 1 relay which is held operated from the No. 8 relay of the trunk circuit. With the removal of the trunk plug the circuit returns to a normal condition.

The ringing current that is on the trunk conductors is transformed by the trunk repeating to the trunk plug and to the No. 3 relay of the trip circuit. This does not in any way affect the proper operation of this relay as the direct current from the No. 2 trunk circuit relay is sufficient to give positive operation. The direct current potential used in this circuit is 40 volts.

INDIANAPOLIS BUILDING REACHES STREET LEVEL

Building operations on the new Indiana Bell Telephone company structure in Indianapolis, Ind., have reached street level. The foundation construction, which was slow because of the complicated nature of the work, has been completed. Erection of the structural steel frame has begun and will go forward rapidly.

Elementary Course In Telephone Practice

In the Fifth Chapter of an Elementary Course in the Study of the Telephone Given Here, O. B. Fensholt, the Author, Applies Rules for Both Simple Series and Parallel Circuits to Combination Circuits, Which Is the Type Which Occurs with Greatest Frequency.

Simple Combination Circuits

We have now covered electrical problems as they are applied to either series or parallel circuits. You will find, though, that in actual practice generally all of our circuits are of a combination of both series and parallel circuits. For example: Lights in houses are connected in parallel, while the house is in series with the line wires and generator.

The same thing is true of telephone circuits. You will seldom find either a simple series or parallel circuit, but rather a combination circuit.

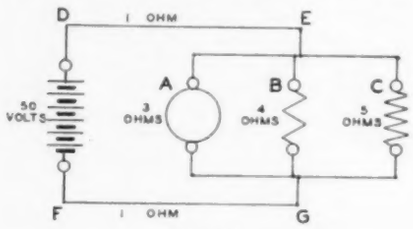


Fig. 13

If you will remember to apply Ohm's law, and your rules for both series and parallel circuits, to each separate part you will find that it is not as complicated as it might look. Also bear in mind that an electric current can only flow in one direction at one time, and cannot back up over itself at some other point.

Let us take a simple combination circuit, as shown in figure 13.

Let resistances A have 3 ohms, B 4 ohms, and C 5 ohms. Let each line wire have 1 ohm each, and a battery pressure of 50 volts. We will now find:

(a) Resistance of the whole circuit.

(b) Resistance of the combination across EG.

(c) Amperes through the whole circuit.

(d) Amperes through combination E to G.

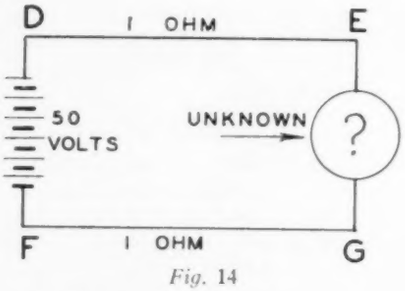


Fig. 14

(e) Volts across E and G.

(f) Amperes, through each separate branch.

Since we have a combination series and parallel circuits, let us rearrange our diagram to a series circuit. We do not know the resistance of the parallel combination across EG until we work it out, so let us call it an unknown resistance.

Our changed diagram will then look like figure 14.

You will notice that we now have a simple series circuit, of 3 resistances, consisting of 2 line wires of 1 ohm each, and one unknown resistance. Therefore, to find the total resistance of the circuit it will be the sum of each separate branch. But since we do not know the resistance across EG we will have to find that first.

Referring back to figure 13, we notice that across E to G is a parallel circuit, so we will take that out and make a separate figure of that, as shown in figure 15.

By applying our rules for parallel circuits, and using Ohm's law, we will find the resistance across E and G.

The conductance (amperes for 1 volt) is $\frac{1}{3} + \frac{1}{4} + 1/5 = .33 + .25 + .20 = .78$ conductance, or .78 amperes per volt of the combination.

Since $O = V/A$, then $1/.78 = 1.28$ ohms, or the resistance of combination EG.

Now, referring back to figure 14, we have found the resistance of the unknown to be 1.28 ohms. Then the total resistance will be 1 ohm + 1.28 ohms + 1 ohm, or a total of 3.28 ohms for the whole circuit.

Referring back to our original problem of figure 13, our answer for (a) is 3.28 ohms. Our answer for (b) we found to be 1.28 ohms. To find the answer for (c) we will apply Ohm's law ($A = V/O$). The total pressure of the combination is 50 volts. The total resistance is 3.28 ohms, then the total current will be $50 \div 3.28$, or $50/3.28 = 15.24$ amperes.

Referring to figure 14, we notice that combination EG is in series with the line wires, and, according to our rules for series circuits, amperes remain the same; therefore, there must also be 15.24 amperes through EG, which is our answer for (d).

Volts Across Combination

Question (e) wants to know the volts across the combination EG. We can go about that in two ways. First: $V = O \times A$. Then ohms of the combination

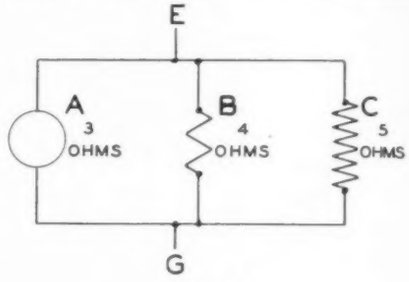


Fig. 15

are 1.28 ohms. Amperes of the combination we found were 15.24 amperes. The $1.28 \times 15.24 = 19.51$ volts of the combination, or our answer for (e). Our second method is by referring to figure 14, EG combination and the line wires are connected in series, and we know that the voltage of a series circuit equals the sum of the volts in each branch. Therefore, if we can find the volts lost in the line wire and subtract that from our total voltage of 50 volts, the remainder will be the voltage across EG combination. Then since $V = O \times A$, the two line wires have

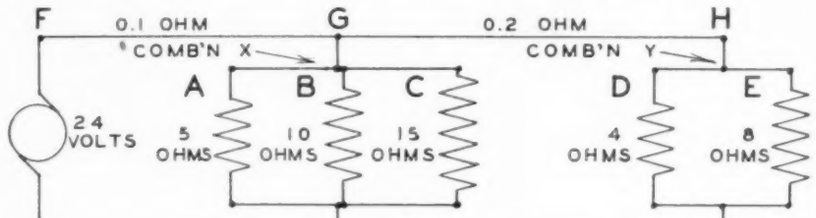


Fig. 16

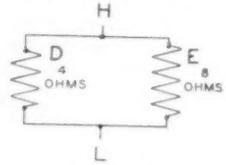


Fig. 17

2 ohms, and 15.24 amperes, so $2 \times 15.24 = 30.48$ volts lost in the line wires. 50 volts less 30.48 volts = 19.52 volts, or total voltage of combination. (You will note a difference of .01 volt, which is on account of carrying our problem only

two decimal places.)

The last question we wish to know is (f): Amperes through each separate branch.

We will apply Ohm's law, A = V/O. From our rule of parallel circuits we know that the voltage of the combination remains the same as in each branch. We found that the voltage of combination EG is 19.51 volts. Now referring to figure 14, if the voltage across EG is 19.51 volts we know it is 19.51 volts across A, B and C. Then the current of A must be (A = V/O) 19.51, 3 or 19.51/3 = 6.5 amperes.

The current of B must be 19.51 ÷ 4 or 19.51/4 = 4.88 amperes, and at C would be 19.51 ÷ 5 or 19.1/5 = 3.9. To check our figures, we know that the amperes of a parallel combination are equal to the sum of the amperes in each separate branch. Then if we add up the amperes through A, B and C it should equal 15.24 amperes, which we found before to be through combination E and G. So 3.90 + 4.88 + 6.50 = 15.28 amperes, which checks our answer. (You will note that here, again, we have a difference of .04 amperes, which is caused by carrying our problems out only two decimal places.)

We have now worked a problem of a single combination of series and parallel

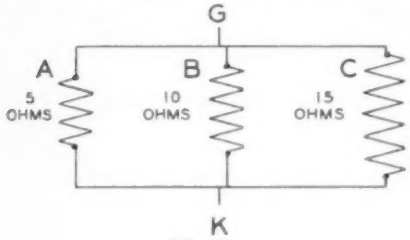


Fig. 18

circuits. Therefore, we will take a problem which may look a little more difficult, but if you will remember Ohm's law and your rules for series and parallel circuits, and apply these to each individual part, it will be no more difficult than figure 13

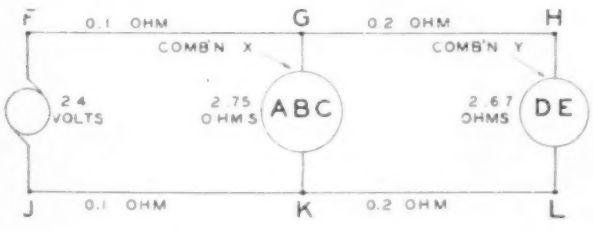


Fig. 19

was, although it might take a little longer time.

We will let figure 16 represent our next problem.

In this problem let us find:

(a) Total resistance of combination Y.
(b) Total resistance of combination X.
(c) Total resistance of last half of circuit (GHLK).
(d) Total resistance of the whole combination circuit.
(e) Amperes of the whole circuit.
(f) Volts across combination X.
(g) Volts across combination Y.
(h) Amperes through combination Y.
(i) Amperes through combination X.
(j) Volts across combination X.

Our first quest, (a), is to find the total

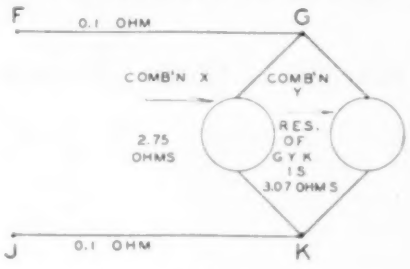


Fig. 21

resistance of combination Y. We will therefore show that as a little diagram by itself, as shown in figure 17.

The conductance of the combination HL is ¼ + ⅛ or is .25 + .125, which equals .375 conductance, or amperes per volt. Therefore the resistance of the combination will be (O = V/A) one volt divided by .375 amperes or 1/.375 = 2.67 ohms, which is the total resistance of HL, or our answer for question (a).

Resistance of Combination

We now want to find the resistance of the combination GK, of figure 18.

The conductance of this combination will be 1/5 + 1/10 + 1/15 or .20 + .10 + .066, or will equal .366 conductance or amperes per one volt. Then by applying Ohm's law (O = V/A), one volt divided by .366 amperes, or 1/.366 = 2.75 ohms, which is the combined resistance of GK, or our answer for the question (b).

Let us now change our figure so that it will look a little simpler.

Let figure 19 be our new figure and it will show the resistances we have just found.

Question (c) asks for the resistance of the last half of the circuit, which

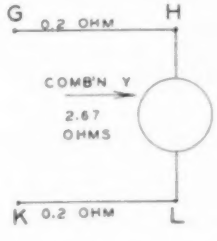


Fig. 20

would be from G, through line G to H, through combination Y (H to L) and through line L to K.

By removing this part of the circuit and making a simple diagram to work with, it will look like figure 20.

Therefore by applying our rule for series circuits, the total resistance of figure 20 will be the sum of the resistances of each branch, which would be .2 + 2.67 + .2, or a total of 3.07 ohms. As figure 20 is actually the last half of figure 19 and figure 16, we then have found our answer to question (c), which would be 3.07 ohms.

Resistance of Circuit

We next want to know in question (d) the resistance of the whole circuit. Again we will make up a diagram to represent clearer what we have found, as shown in figure 21.

The conductance of the combination across GK will be 11/2.75 + 1/3.07 or .363 + .326 = .69 amperes. The resistance of the parallel combination across GK, will then be 1/.69 or 1.44 ohms. Then the resistance of the whole circuit must be .1 ohm + 1.44 ohms + .1 ohm or a total of 1.64 ohms, which is our answer for (d).

Question (e) asks for the amperes through the whole circuit. According to Ohm's law A = V/O. Therefore, referring back to figure 16, we see the volts of the whole circuit are 24 volts, and we found the total resistance was 1.64 ohms, then 24 ÷ 1.63 or 24/1.64 = 14.63 amperes, or our answer for (e).

We now wish to find the voltage across combination X.

Referring to figure 21, we will make that a little simpler, as shown in figure 22.

We have found that the resistance from G to K was 1.44 ohms, and we also found that the total current for the circuit was 14.63 amperes. Apply our rule regarding amperes of a series circuit remaining the same, we then know that

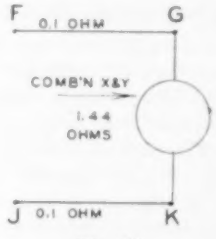


Fig. 22

there must be 14.63 amperes through G to K. Now by applying Ohm's law (V = O × A) 1.44 ohms multiplied by 14.63 amperes equals 21.07 volts across GK.

Referring back to figure 21, you will notice that combination X is part of the parallel circuit across GK, and since we know that volts remain the same in a parallel circuit, there must be 21.07 volts across X, or which is our answer to question (f).

Another way to check that would be to find the volts lost in wires FG and JK (refer to figure 19) and subtract these volts lost from the total voltage, and the balance will be across combination X.

V = O × A. The amperes in the line wires FG and JK are found to be 14.63 amperes, then .1 × 14.63 = 1.46 volts lost in one wire. So 2 times 1.46 = 2.92 volts

(*Continued on page 30.*)

Telephone News From the Southwest

Notes of Telephone and Utility Interests in the Central Southwest Which Previously Were Reported for Transmitter and Electrical Journal, a Regional Magazine of that District Which Has Been Absorbed by TELEPHONE ENGINEER, Appear in the Following Columns

Tidings From Texas

The Gulf States Telephone company, with headquarters at Tyler, has increased its capital stock from $250,000 to $310,000. Judge S. A. Lindsay of Tyler is president of the company.

The Southwestern Bell Telephone company has just moved into new exchange quarters at Whitewright. Contract was let on June 17th for a combination office and residence by J. H. Waggoner, who has leased the property to the telephone company for a long term of years.

C. H. Jennings of Fabens, Texas, has secured a twenty-five-year franchise for the installation of a telephone exchange at Saginaw. Mr. Jennings is owner of the Central Texas Telephone company, and according to the terms of his franchise must have the plant in operation within one year.

Rio Grande Company Gets Increase

Effective August 1st, the date following the cutover to the new central exchange, the Rio Grande Valley Telephone company was granted an increase of 25 cents per month on all classes of service at Brownsville, Texas. J. C. Paxton is general manager of the company and E. E. Mockbee is local manager. The Brownsville Herald under date of July 30th, got out a special telephone edition, setting forth the many improved features of the new equipment and service accompanied by photographs of the new building, and a number of interior views.

The Harris-Fort Bend Telephone company was recently incorporated, with a capital of 250 shares of no par value stock. This company serves several hundred patrons in the Fort Bend industrial community.

The Southwestern Bell Telephone company has awarded a contract for a new two-story Woodlawn exchange building in Laurel Heights. The total cost of the building will be about $150,000. Laurel Heights is a suburb of San Antonio.

The city commission at Sherman has attacked the rate schedule of the Municipal Gas company of that city. At their request, a bill was passed by the last session of the legislature, appropriating the sum of $80,000 as an expense fund for the state railroad commission, which has jurisdiction over such matters, to make a thorough investigation of the gas situation, not only at Sherman, but elsewhere in the state.

Underground Toll Cable

The underground toll cable being installed by the Southwestern Bell Telephone company between Oklahoma City and Tulsa in Oklahoma, and Dallas, Texas, is rapidly nearing completion. The repeater station, erected at Luella, in Grayson county, Texas, has been completed and practically all the equipment has been installed. The cost of the building at Luella was in excess of $40,000. According to present plans this added section of the underground long distance system of the Bell company, will be in use before the end of the year.

Following the epidemic of bank robberies in Texas last summer, the telephone companies did a rather lucrative business installing telephones in bank vaults for use in case employees of the banks should be shut in by the robbers.

This Is Real Service

From Dallas comes the story of a citizen of that city who went hunting in east Texas. While there he ran across a very fine pointer dog named Bill. He did not learn the name of the owner of the dog but after his return home he decided that the ownership of Bill was absolutely necessary to his happiness. He finally laid the matter before Miss Ethel Barlow, long distance operator, and told her that Bill and his owner lived somewhere between Sulphur Springs and Como. In just seven minutes, the owner was on the line, the dog bargained for and the deal closed. The dog is now at home with J. A. Wilkerson, deputy game warden in charge of the fish hatchery at Fair Park. The former owner was John Dewberry, located on a rural route near Como.

Plano Reaches Agreement

The case of the city of Plano vs. the Northern Texas Telephone company has been settled by agreement. The city filed suit against the telephone company by seeking a return to the old rates stipulated in the franchise granted to the Union Telephone company in 1918. The rates as set forth in the franchise were $1.50 and $3.00 per month for residence and business telephones respectively. About 1920, a former owner of the exchange advanced the rates to $2.50 per month for residence telephones and $4 per month for business telephones, which rates have since been in effect. According to the agreement reached between the contending parties, the rates on and after September 1st will be $1.75 for residence telephones and $3.50 per month for business telephones. The Northern Texas company operates a common battery system in Plano with approximately 350 subscribers.

Observations From Oklahoma

Oklahoma Holds Three Mid-Summer Telephone Meetings

Three mid-summer meetings of the Telephone division, Oklahoma Utilities association, were held at Duke, Medicine Park, and Sulphur, August 25, 26 and 28, respectively.

C. G. Gardner, Oklahoma City, sales representative, Kellogg Switchboard and Supply company, and chairman of the Telephone division, presided at all three meetings.

The meeting at Duke was under auspices of the Peoples Telephone company with T. W. Alexander, man-

ager of that company, as acting secretary. The business meeting was held in the First Methodist church, and a noon-day luncheon at the Commercial Hotel. The principal address of the meeting was delivered by S. I. McElhoes, Oklahoma City, president Oklahoma Utilities association and vice-president, Southwestern Light and Power company. The subject of his address was "One Remedy for the Next Depression." Mr. McElhoes also spoke at the Medicine Park meeting.

The gathering at Medicine Park was held under auspices of the Southwestern Bell Telephone company and Southwestern Light and Power company. C. B. Gales, Lawton, district manager of the former company, was in charge. Addresses delivered at the business meeting included "As Telephone People, Our Responsibility," by A. G. Davidson, Frederick, district manager, Southwest Telephone company; and "Toll Operating Practices," by C. C. Luman of Lawton.

The Sulphur Telephone company with Frank Crawford as manager, sponsored the Sulphur meeting. H. M. Stewart of Dallas, Texas, district manager of the Kellogg Switchboard and Supply company addressed the luncheon on "Commercial Service."

Subjects predominating in discussions at the three meetings were: rural line telephone service, public relations, commercial and traffic practices, accounting, construction methods, local and long distance service, maintenance of plant, collections, and extension of credit.

Dates and places for two late summer district meetings have been announced for Wetumka, September 22, and Welch, September 24.

Officials of Comanche, Okla., have filed an application with the Oklahoma Corporation commission for a reduction in telephone rates charged by the Southwest Telephone company at Comanche.

J. J. Couch of Oklahoma City, about 25 years old, an employe of the Southwestern Bell Telephone company, was killed in an automobile accident near Krebs, Okla., recently. Mr. Couch had been installing a new switchboard in the company's new building at Hartshorne, Okla., and was returning to Oklahoma City when the accident occurred.

Legislate Against Sale and Use of Slugs

The manufacture, use and sale of slugs, such as are often fraudulently used in place of coins in pay telephones, stamp selling machines and other self-serving appliances, has been prohibited by an ordinance adopted by the city commissioners at Tulsa, Okla. Violators may be fined from $25 to $100 and sentenced to 30 days in jail. Companies making slugs in nickel, dime and quarter sizes have been doing a large business there, selling them at four for 5 cents, according to Thomas I. Munroe, police and fire commissioner.

An investigation is being conducted by city officials of Blackwell, Okla., to determine the status of the Southwestern Bell Telephone company's operating franchise in that city. The company has operated in Blackwell since 1929 without a franchise according to Mayor L. N. Conser.

The Southwest Telephone company is planning to make improvements to its system in Cement, Okla. Cable lines will replace open wires in some sections of the city and other improvements not yet announced, will be made.

Holdenville Asks Investigation of Rates

A petition has been filed with the Oklahoma Corporation commission by A. W. Scott, mayor of Holdenville, Okla., asking for an investigation of telephone rates in that city.

The Southwestern Bell Telephone company recently completed improvements in Holdenville costing approximately $350,000. The Holdenville city commission at the time the improvements were started agreed to an increase in rates when the new system was installed. Upon the showing of this agreement the Oklahoma Corporation commission made Journal Entry 1836 authorizing an increase in rates to be effective when the improvements were completed. The new rates went into effect with the July, 1931 bills. The petition asking for lower rates is signed by a number of users in Holdenville.

Miss Alpha Wilkerson has been appointed manager of the Meeker office of the Southwest Telephone company to replace Miss Inez Brock who has resigned to accept another position.

The July issue of "The News," a publication printed by the Southwest Telephone company in Dallas, Texas, carried a picture and write-up of H. H. Dye, plant manager of the Erick exchange of that company, in recognition of his having won high honors and a handsome gold watch given as first prize for the largest number of sales for the first six months of 1931.

The Fort Gibson (Okla.) Independent in a recent issue said in part: "The telephone companies are being hit hard by the high taxes and are entitled to a reduction. The tax gatherers make a mistake in not being more lenient with the telephone companies and do not take into consideration the great benefits derived by promoting work to help the populace and besides they are an inspiration to business."

The telephone system at Gage, Okla., is being reconstructed by the Southwestern Associated Telephone company. New poles are being set and new wire being strung. A new switchboard and equipment will also be installed.

Telephone Operator Reports Doctor's Calls

Although out of her line of duty a telephone operator in the local exchange of the Southwestern Bell Telephone company at Elk City, Okla., kept a list of people who tried to call a city physician's office during fifteen minutes when the assistant to the doctor's office was absent. When the office girl returned the operator reported to her the names of the persons who had placed calls to the physician.

Oklahoma and Texas Companies Unite for Mutual Benefit

Announcement was made in Oklahoma recently that all telephone exchanges that have been operated in Oklahoma under the name of Oklahoma Associated Telephone company, and in Texas under the name of Texas Associated Telephone company, will now be united under the name of Southwestern Associated Telephone company. This combined group passes under the control of the Associated Telephone Utilities company, one of the larger companies in the Independent group. This change will mean greater financial resources for the company and a more extensive program of improvements to exchanges in Oklahoma and Texas.

Charging non-payment of corporation license fees on a part of the capital stock invested in Oklahoma since 1920, J. Berry King, Attorney General of Oklahoma, at the direction of Governor William H. Murray filed suit in the District Court of Oklahoma county seeking to collect $644,203.78 claimed due from the Southwestern Bell Telephone company as tax and penalty.

The Western Telephone Corporation of Oklahoma has agreed to install a common battery telephone system at Kingfisher, Okla. Work will be started in January and should be completed by next summer. The new system will replace the old magneto exchange.

Telephone Activities in Foreign Countries

Dispatches from Abroad Keep Telephone Men in United States Constantly Informed Concerning Telephony of the World; Domestic Telephone Problems Oftentimes Can Be at Least Partially Solved by Watching the Outcome of Experiments Made Elsewhere

Long Distance Installations in China

Efforts are being made to install long distance lines connecting various cities and towns in China. Considerable progress has been made in this direction in Manchuria. Public telephone communications are also in operation between Peiping and Tientsin, Nanking and Shanghai, Hangchow and Shanghai, Canton and Hong Kong, and a number of other cities and towns in China, but the sum total of business done on these lines is still lamentably small.

Authorities in Kiangsu Province at the lower end of the Yangtsze Valley are planning on long distance installations for that section.

International Telephone Developments of Bulgaria and Greece

Preparations are being made to link Bulgaria and Greece by telephone through Koula on the Greek-Bulgarian frontier, according to an announcement made by the Director of the Post, Telegraph and Telephone service of Bulgaria.

Telephone communication has been successfully established between Saloniki and Skoplje and Belgrade. Because of the difference in the intensity of the curents available on the Saloniki-Skoplje-Belgrade line and the Saloniki-Athens line it will not be possible to communicate for the time being between Belgrade and Athens until the suburban Saloniki-Athens line, now under construction, is completed. Operators speaking the French language will be employed on this line in order to facilitate communications.

The German firm of Siemens-Halske, which recently obtained a contract from the Greek Government for the installation of an automatic telephone system in Greece, has commenced preliminary work in the city of Saloniki, where a technical bureau has been organized for the purpose. Plans are being prepared and the actual work of installing the cables will take place early in 1932.

Although the telephone service in all the main cities of Greece has been entrusted to Siemens-Halske, the telephone system of Greece will be operated by the Government until completion of the new lines.

1930 Swedish Telephone Statistics Announced

At the close of 1930 the Swedish telephone and telegraph service had 522,450 telephones in use, according to the annual report. The number of automatic installations at the same time was 67,082. The total length of the telephone lines in Sweden is 935,-339 kilometers, with 56,677 kilometers overhead telephone wires and cables.

The surplus yielded by the entire telephone system in Sweden amounted in 1930 to 25,114,156 kroner, or 7.87 per cent of the invested capital, which amounts to 322,961,390 kroner.

(One krona equals approximately $0.268.)

Telephone Communications in Macedonia and Thrace

In the territory under the jurisdiction of the Government General of Thrace, which includes the Province of Thrace and the regions of Drama and Kavalla in Eastern Macedonia, 168 kilometers of new telephone lines were constructed, and 67 kilometers of the old lines were replaced by new ones in 1930.

Twenty-six new communities have been connected by telephone. Three new exchanges were installed, one at Drama for 400 subscribers, another at Komotini for 200 subscribers, and a third at Alexandropolis for 200 subscribers. A sum of 3,021,073 drachmas ($39,240) was expended on these works by the provincial telephone treasury. Its funds are obtained from the proceeds of a special tax and contributions from the various communities which benefit by the improvements.

During the present year the provincial telephone treasury expects to construct an additional 500 kilometers of new telephone lines and to install four exchanges at Orestias, Didimotihon, Soufli and Elefteropolis at a cost of 4,750,000 drachmas ($61,687).

Great Britain Negotiates with Belgium for Anglo-Belgian Cable

The British Government has had negotiations with Belgium concerning the laying of a new telephone cable between St. Margaret's, in England, and La Panne, in Belgium. The British authorities foresee a considerable extension of traffic with the Continent and wish to provide circuits for such distant countries as Turkey, Bulgaria and Rumania.

Amplifying stations will be erected on both the British and Belgian coasts and the cost will be shared by both countries. According to present plans the cable will be laid in 1932 and put into service at the beginning of 1933.

A service is now in operation between Great Britain and Rumania, and communication is available from all parts of Great Britain and Northern Ireland, but is restricted initially to certain towns in Rumania, including Bucharest, Braila, Constanta, Galatz, Oradea Mare, and Timisoara. The service will be extended as soon as conditions permit and subscription calls, at half the day charges, may be obtained between 7 p. m. and 9 a. m.

Experimental Service Between Tangier and Europe

An experimental radiotelephonic service, which after a trial period of one month is expected to be made permanent, has been inaugurated recently between Tangier (International Zone of Morocco) and the principal countries of Western Europe, as well as with the cities in the French Zone of Morocco. Connections with Europe are made via the French Government wireless stations at Rabat and Paris, and from the latter place the wires are used to extend the service to England, Belgium, Germany, Austria, Hungary, Netherlands, Sweden, Czechoslovakia, Switzerland and Spain. Connections are also made at Rabat with the Government-owned telephone system which links the principal cities of French Morocco. In order to communicate by telephone with Ceuta, a city 30 miles distant from Tangier, the voice is carried by wireless to Rabat and thence, also by wireless, to Paris, where it follows the telephone wires through France and Spain, and under the Straits of Gibraltar, to Ceuta.

ORDERS STROMBERG SWITCHBOARD

A single unit No. 106 Stromberg-Carlson Switchboard has been purchased by the Peoples Independent Telephone company for Winthrop, Minn. The board will be equipped with 220 central energy and 16 toll and rural lines and will be complete with terminal, power and machine equipment.

THE TECHNICAL CLEARING HOUSE

B. C. BURDEN, Editor

The Useful Slide Rule

Q.—Does the operation of a slide rule require a knowledge of advanced mathematics on the part of the operator?

A.—No. Anyone who can divide, add, and multiply can learn to use the slide rule with a few weeks' practice. Instruction books are sold with slide rules, and with these it is a simple matter to learn to operate the rule. A slide rule is a very useful instrument for any operating telephone man. They can be purchased at prices ranging from $1.00 to $10.00.

Output Voltage of Magneto Telephone

Q.—What voltage is impressed across the terminals of a magneto subset which is connected to a 600 ohm line, when spoken into in an average voice?

A.—Using a Weston-Model 571 A. C. output meter a Western Electric magneto subset with 2 dry cells and a No. 337 transmitter gives a voltage reading of 1.3 volts when the word "hello" is spoken into the transmitter.

Only a rectifier tube voltmeter can be used to measure the output voltage, as ordinary type voltmeters will not respond to frequencies in the voice range.

The D. B. Mile of Standard Cable and 800-Cycle Mile

Q.—What is the difference in magnitude between the db, the M.S.C., and the 800 cycle mile transmission units?

A.—The decibel is approximately 5½ per cent greater than the 800 cycle mile, and 6 per cent smaller than the mile of standard cable unit.

Heat Coil Protection

Q.—What is the purpose of the heat coil, and what are the operating characteristics of modern type coils?

A.—The heat coil is used to protect central office equipment from small currents which if allowed to flow through the equipment for a prolonged period might start a fire. They are so designed that they will carry approximately ⅓ ampere for several hours, but will operate so as to ground the incoming line if a current of ½ ampere flows for longer than 3½ minutes.

Lightning Effects

Q.—We experience considerable trouble each summer from lightning. Does lightning actually have to strike a live wire to blow fuses and damage instruments, or can excessive voltages be developed by induction as the result of lightning discharges to earth?

A.—The majority of trouble caused by lightning to telephone lines results from induction due to electrified clouds discharging to earth, or to discharges between clouds. Occasionally a line may suffer a direct hit in which case the line wire may be melted and poles shattered.

The induced voltages from lightning will vary from a few hundred to several thousand volts.

Cable Capacity

Q.—What is the average capacity between wires of No. 22 and No. 24 gauge paper insulated cable?

A.—Present day cable runs about .065 to .075 m.f. per mile. Cable made some years ago was of looser core construction, and would run about .060 to .065 m.f. per mile.

Conduit for Telephone Service

Q.—What size rigid conduit is required to care for building telephone service, when using No. 19 Duplex inside wire?

A.—The following table is followed by many companies with regard to conduit sizes:

No. Pairs Duplex	Max. No. Bends	Pull	Size
1	4	0-200′	½″
1	6	0-100′	½″
2-4	4	0-20′	¾″
2-4	2	0-40′	¾″
2-4	1	0-200′	¾″
5-8	4	0-50′	1″
5-8	2	0-100′	1″
5-8	1	0-150′	1″

ELDRIDGE LEAVES HOSPITAL AFTER TEN WEEKS

Frank L. Eldridge, who received a fractured spine and other injuries when he fell down an elevator shaft in Abilene, Kans., while attending the Kansas Telephone Association convention early in June, was recently discharged from the Ravenswood Hospital.

Mr. Eldridge, who is head of the Frank L. Eldridge company, 11 South La Salle street, Chicago, Ill., expects to return to his office in October.

ACHATZ ASSUMES ADDITIONAL POSITIONS

R. V. Achatz, for many years editor of Telephone Engineer, has been elected president and general manager of the Ohio River Telephone company, Rising Sun, Ind. He succeeds the late C. R. Green. The Ohio River company is closely associated with the Southern Indiana Telephone company, of which Mr. Achatz is general manager and secretary.

Prior to assuming the editorship of Telephone Engineer Mr. Achatz was an instructor in Electrical Engineering at Purdue university.

PEORIA TO ENTERTAIN STATE TELEPHONE MEN

The annual convention of the Illinois Telephone association, held in Peoria last year, will again be entertained by that city, November 18 and 19.

Four hundred delegates attended the convention last fall and a similar number is expected this year.

FIRST POWER LINE TELEPHONE CIRCUIT ESTABLISHED IN AUSTRALIA

A telephone circuit has been established by the Victorian Electricity commission over its 132-kv power line between the Yallourn generating station and the terminal station at Richmond in Melbourne. The equipment was supplied by the German Telefunken company. A high-frequency carrier system is used, the speech current being imposed on, and tapped from the power line through 5-foot porcelain condensers. Between the latter and the main power transformers choke rejectors are connected to impede the high-frequency carrier current, while allowing the low-frequency power current a free passage. This is the first installation of its kind to be used in Australia.

A. T. U. ACQUIRES TELEPHONE PROPERTY IN IDAHO

Associated Telephone Utilities company has acquired the Home Telephone Company, Ltd., of Genesee, Idaho, it was announced recently. The new property is near territory already served by the Associated system.

Permission has been granted to Associated Telephone company to acquire the properties of other operating units of the system in California. This represents a further step in the system's program of consolidation of operating properties within state areas.

Dramatizing Ou

This summer, keep the family together by telephone!

"Now lift Betsy up to the telephone, dear. . . . Hello, honey. Dad's sort of lonely for you. . . . Well, just keep on splashing and you'll learn to swim!"

* * *

SUMMER often scatters the family far and wide. Junior's away at a boy's camp. Mother and the twins are at seashore or lakeside. Dad holds the fort at home and slips away week-ends.

But all of the family are likely to miss each other sometimes. Then there's nothing so satisfying as a telephone call. It's easy, quick and *personal*. It's inexpensive too.

To most places 25 miles away, the station-to-station day rate is about 25 cents; 40 miles away, 35 cents; 75 miles, 50 cents; 150 miles, 80 cents. Many rates are even lower during evening and night periods.

Let your *telephone* take you shopping!

"Eight single sheets and pillow cases, at the sale price . . . a set of mixing bowls in blue and ivory . . . and a dozen cakes of your special hard-water soap."

* * *

THE telephone simplifies shopping. Try it, even when the stores are miles away. Many of them have special sales people to handle your orders.

Wherever you want to go, your telephone will take you—to children away at school—to friends in other cities—to the folks "back home." It is *personal*, quick and inexpensive.

To most places 15 miles away, the day station-to-station rate is about 15 cents; 25 miles away, 25 cents; 40 miles away, 35 cents. Rates are lower during the evening and night periods.

Out-of-town Service

FOR THE HOME

THE home telephone is such a familiar instrument that its full range of service is frequently forgotten.

To show women, particularly, the ease and economy of out-of-town calls, advertisements like the two on the opposite page are appearing regularly in a number of women's publications.

These advertisements are planned to show the human side of residence toll service—to picture it as the friendly, useful sort of servant that it is. They indicate appropriate occasions for its use—when weddings or anniversaries occur, when friends move to other cities, when children are away at school or on vacation.

The essence of these advertisements is in their natural, conversational sub-captions. Each is a little incident out of the day's existence, planned to catch the pleasant warmth of a human voice, carried across the miles, and clearly suggest that "talking is next best to seeing." The rest of the text briefly develops the central situation and includes a list of toll charges for various distances to prove low cost.

Readable advertising of this kind is reaching millions of women each month—and its effect should be felt by the entire telephone industry—both Bell and connecting companies.

An Advertisement of the American Telephone and Telegraph Company

VACUUM TUBE THEORY AND PRACTICE

SUBJECT: AMATEUR SHORT WAVE TRANSMITTERS

General

In the July issue of TELEPHONE ENGINEER, a plan to organize a group of short wave amateurs to be composed of telephone men was discussed. As a result of this article, a large number have written in saying that they desired to

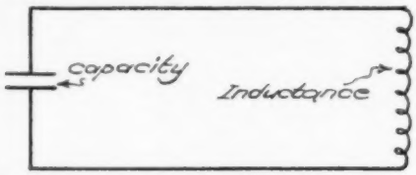


Fig. 1—Elements of an oscillatory circuit

join this group, and from all indications a number of amateur stations operated by telephone men will be on the air by the time cold weather arrives.

As previously stated, this group is being organized for the purpose of interesting telephone men in a hobby which will give both pleasure and instruction. Interest in amateur radio will insure that those interested are keeping abreast of the latest technical developments in the radio world, and the information gained cannot help but lead to a better understanding of the technical features of telephone plant operation.

This article discusses several types of amateur transmitters which can be built at a very reasonable cost. An inspection of the diagrams should convince anyone that a transmitter is much simpler than a receiver to construct.

Oscillatory Circuits

A short wave transmitter may be considered as being a means for generating high frequency alternating currents. Because of the extremely high frequencies involved currents in radio frequency circuits are usually referred to as "oscillating currents" rather than "alternating."

High frequency alternations are generated by means of one or more vacuum tubes connected in a circuit containing inductance and capacity, and which is tuned to the desired frequency.

Both radio transmitting and receiving circuits depend for their operation on the properties of the oscillatory circuit such as that shown in Figure 1.

An oscillatory circuit consists of inductance and capacity in series. The operation of such a circuit can best be understood by assuming that with the inductance coil and condenser connected together as shown, a voltage is in some way impressed across the condenser, so that one plate is charged to a positive potential and the other a negative potential. The condenser being connected across the coil, a current will tend to flow from the positive to the negatively charged plate. Due to the electrical inertia of the inductance the electro-magnetic field around the coil builds up slowly. When the current flowing in the circuit reaches its maximum value and starts to grow smaller the magnetic field built up around the inductance begins to collapse thus cutting the turns of the coil and generating a voltage across the coil which tends to maintain current flowing in the circuit in the same direction as the current which created the field. The effect of this is to charge the condenser plate to opposite polarity. The condenser then starts to pass current through the coil in the opposite direction, and the

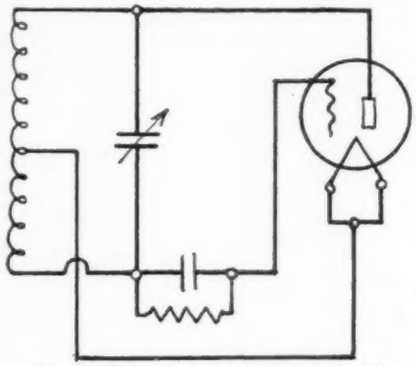


Fig. 2—Schematic of Hartley circuit

charge on the condenser plate is again restored to the initial polarity. If a zero center d. c. ammeter was inserted in the circuit as shown, the needle would deflect from zero to a maximum reading on the positive scale then fall back to zero and deflect to a maximum reading on the negative scale. It will be seen that a single alternating current cycle is thus completed. This cycle will be repeated over and over until all of the electrical energy present in the initial charge is dissipated by the ohmic resistance of the coil and condenser.

The amplitude of each succeeding cycle diminishes until the amplitude is zero. Such a wave is said to be "damped."

The frequency of the oscillations of a tuned circuit is determined by the magnitude of the inductance and capacity of the coil and condenser.

The formula which expresses frequency is:

$$f = \frac{159.15}{l\ c}$$

Where:

f—frequency in kilocycles per second.
l—inductance in microhenries.
c—capacity in microfarads.

It will be seen from the formula that the frequency increases as either the inductance or capacity is reduced.

Short Wave Transmitting Circuits

By utilizing the tuned circuit just described in conjunction with vacuum tubes it is possible to generate "undamped" or "continuous" waves.

This is accomplished by connecting the tuned circuit in either the plate or grid circuit of the tube and arranging for energy to be fed from the output back to the input. Sufficient energy is fed back to keep the tuned circuit in continuous oscillation.

The two best known transmitting circuits are the "tuned plate-tuned grid" and the "Hartley Circuit." The tuned plate grid circuit shown in Figure 3 feeds energy from the plate back to the grid circuit through the inter-electrode capacity of plate and grid.

The Hartley circuit shown in Figure 2 feeds back energy from plate to grid circuit through the inductive coupling between the grid and plate ends of the common inductance coil.

Single Control Tune Plate-Tuned Grid Transmitter

One of the simplest and yet very efficient one tube transmitters utilizes a mod-

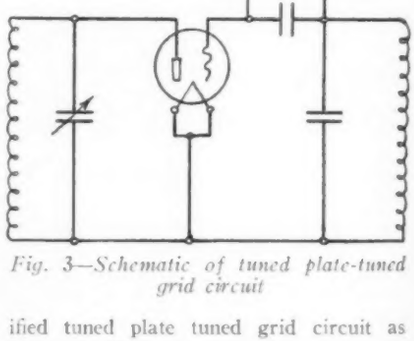


Fig. 3—Schematic of tuned plate-tuned grid circuit

ified tuned plate tuned grid circuit as shown in Figure 4.

The necessity for tuning the grid circuit in this transmitter is eliminated by using a fixed tune grid coil having sufficient turns so that it will resonate over the desired frequency range.

The plate coil L_1 is made from ¼-inch soft copper tubing wound on a 2⅜-inch form. A five turn coil should be used for the 7,000 kilocycle band, and a 12 turn coil for the 3,500 kilocycle band. The grid coil L_2 is made from No. 30-

DCC wire wound on a 1-inch diameter bakelite or micarta tube. A 25 turn coil should be used for the 7,000 kilocycle band and a 60 turn coil for the 3,500 kilocycle band.

The condenser C_5 is a Cardwell type 407-13. This type condenser is shown in Figure 6. The miscellaneous by pass condensers should have values as shown and may be of the mica dielectric type such as are used in broadcast receivers. These condensers are used to by pass radio frequency return currents to the filament.

The resistance R_2 should have a rating of 5 to 10 watts. This resistance determines the negative voltage on the grid. A type 510 DeForest tube is used as the oscillator. Figure 8 shows two popular types of DeForest transmitting tubes.

The choke L_3 can be made by winding 300 turns of No. 38 d.s.c. (can be obtained from an old ringer) on a ½-inch wooden dowel. The filament and plate transformers for the transmitter can be obtained from the E. F. Johnson company at Waseca, Minn. In case it is desired to buy the plate inductance rather than build one the Johnson type 2131-K is recommended.

Salvaged telephone condensers may be used in the rectifier filter, by connecting two or three in series in order to reduce the voltage across each condenser to a safe value. The purpose of the rectifier is to step the 110 volts up to 500 volts, and then rectify this to d.c. voltage by means of a two element DeForest type 580 rectifier tube. The filter system smooths out the rectified a.c. so that direct current with very little ripple is obtained.

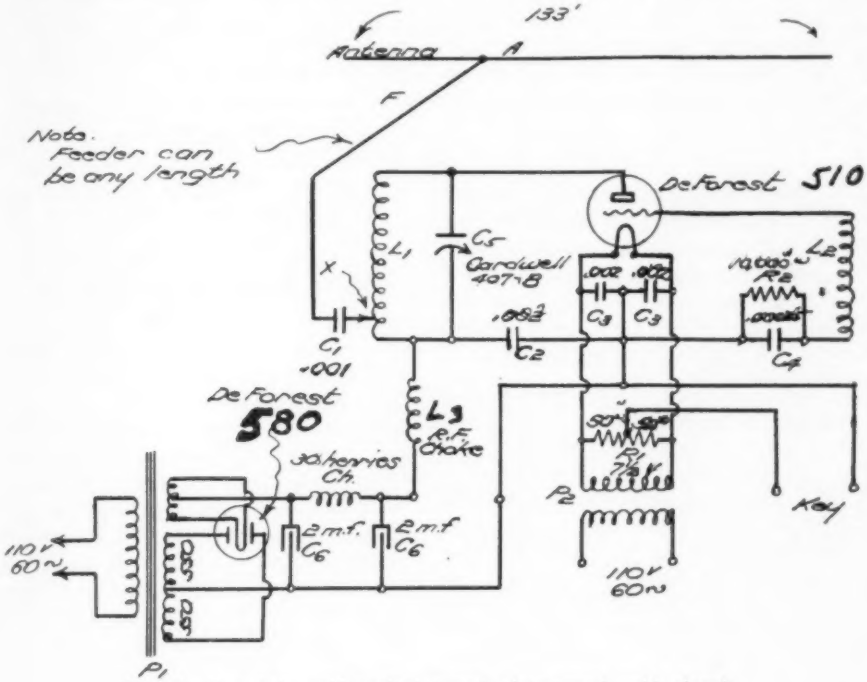


Fig. 4—One tube self-excited tuned plate-tuned grid circuit

Space does not permit explanation of amateur antenna systems other than to point out that the success of a transmitter in "getting out" depends in a large part on getting the antenna system in tune with the transmitter frequency. The "American Radio Relay League's Handbook," which is an essential part of every amateur station, should be consulted for information on the proper type antenna system to use.

Transmitter Operation

When the transmitter is ready for operation the main switch should be closed, thus lighting the filament of the oscillator tube and turning on the rectifier. With the key closed the plate condenser should be rotated until a small flashlight lamp connected to a single turn of wire and held close to the end of the plate coil glows brightly. This indicates that the transmitter is oscillating. The frequency of the oscillations being generated must then be checked with a home made frequency meter (see A. R. R. L. handbook). The condenser C_5 should be adjusted to give maximum brilliancy on the flashlight lamp with the generated frequency well within the band.

The transmitter is now ready for connection to the antenna.

Telegraph signals are transmitted by opening and closing the telegraph key which starts and stops the tube from oscillating.

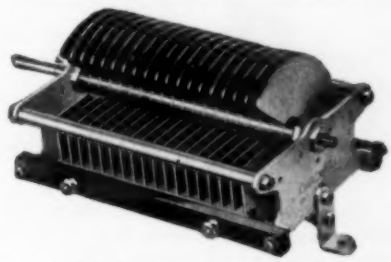


Fig. 6—Cardwell transmitting type condenser

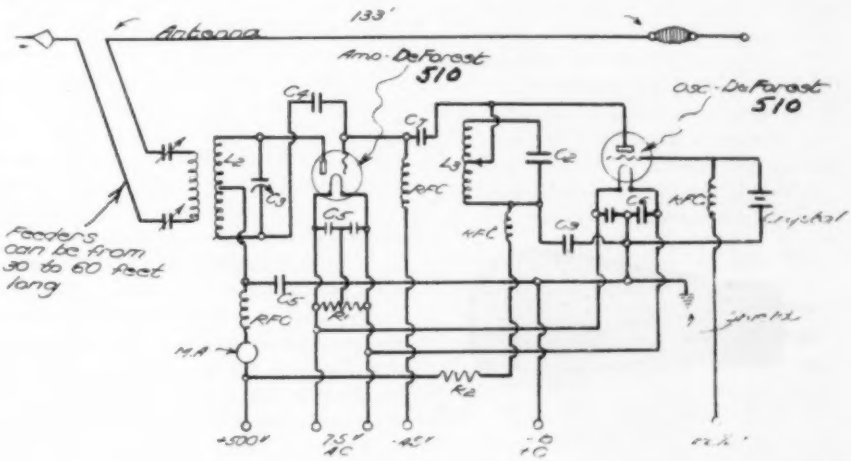


Fig. 7—Crystal control transmitter

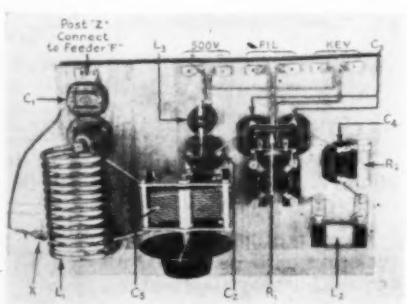


Fig. 5—One control transmitter

Crystal Control Transmitters

Transmitters of the "self excited" type just described have one serious disadvantage, viz., the transmitted frequency may "wobble," thus making the signal difficult to read, and also causing interference to other amateurs who may be transmitting on adjacent channels.

This variation in frequency results from a number of different causes, and by careful adjustment a very satisfac-

tory signal of constant frequency can be obtained.

A type of transmitter which eliminates "frequency wobble" and which insures the station is always well within the amateur band is the crystal control transmitter.

Such transmitters are not expensive to construct and are very effective in "getting out." The signal from a crystal

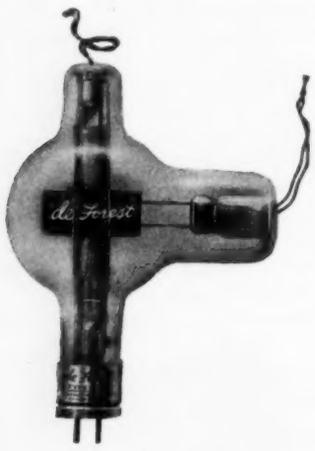


Fig. 8—DeForest type 552 transmitting tube

controlled transmitter is a clear "flute like" whistle, which is easy to read and which cuts through interference.

The crystal controlled transmitter consists essentially of a small slab of crystal (1-inch square approximately) which is placed in the grid circuit of a vacuum tube the output of which is connected to another tube which functions as an amplifier stage.

The crystal controls the frequency of the tube to which it is connected by virtue of its electro-mechanical characteristics. The frequency depends upon the thickness of the crystal.

A simple crystal controlled transmitter is shown schematically in Figure 7.

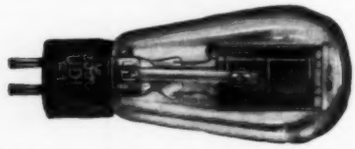


Fig. 9—DeForest type 510 (7½) watt transmitting tube

This circuit differs from the self excited transmitter shown in Figure 6, mainly in the addition of the second crystal controlled tube and the necessity for neutralizing the final output amplifier.

For those who desire to build a real transmitter crystal control is recommended. Anyone desiring information on crystals may write H. Hollister of Merriam, Kansas, who has had a wealth of experience with crystals and crystal controlled sets, and who has been working with crystals for a number of years. Mr. Hollister has very kindly offered his assistance in the organization of the proposed group of telephone amateurs.

Complete information on how to become affiliated with the proposed group of telephone amateurs together with technical data on receiving and transmitting sets can be obtained upon request to B. C. Burden, Transmission Engineer, Lincoln Telephone & Telegraph company, Lincoln, Nebraska. (10 cents in stamps should be included to cover mailing costs.)

ELEMENTARY COURSE IN TELEPHONE PRACTICE

(*Continued from page 21.*)

lost in both wires. Therefore 24 — 2.92 = 21.08 volts, which checks with our other answer.

Voltage of Combination

Our next question, (g), asks for the voltage of the combination Y. We will first refer to figure 19. We have just found that there are 21.07 volts across GK. Now referring to figure 20, we have left off the first half, but we still have our 21.07 volts across GK. We then know that the voltage in Y must equal the voltage of GK, less the volts lost in the wires GH and JK; or the volts in Y will be the ohms in Y multiplied by the amperes through Y. Since we need to know the amperes in this circuit, let us refer to figure 21. We know the total volts across GK is 21.07 volts. The ohms across GYK is 3.07 ohms. Then the amperes equal (A = V/O), 21.07 ÷ 3.07 or 21.07/3.07 = 6.83 amperes.

We will now find the volts across combination Y, using two methods. First, by Ohm's law. Let us therefore refer to figure 19. This is a series circuit. We have found that there are 6.83 amperes in this circuit, and we know that the amperes of a series circuit remain the same, then there must be 6.83 amperes across Y. We also found that there were 2.67 ohms across Y, then by Ohm's law (V = O × A) 2.67 multiplied by 6.83 or 18.23 volts, which is our answer for (g). The second method is to find the volts lost in the line wires. By Ohm's law (V = O × A) .2 ohm in one wire multiplied by 6.83 amperes in the wire equals 1.366 volts, then in the two wires will be 2 × 1.366 or 2.73 volts lost in the wires. Then subtract 2.73 volts from 21.07 volts = 18.24 volts at Y.

Our next question (h) wants the amperes of the combination at Y. This we have just found to be 6.83 amperes.

In question (i) we wish to know the amperes through combination X. We can use two methods. First, we will refer to figure 21. We know that the amperes of a parallel circuit equal the sum of the amperes in each branch. Therefore, the amperes through Y plus the amperes through X should equal the total amperes, or which we found to be 14.63 amperes. We also know that the amperes through Y are 6.83 amperes, then the difference between 14.63 amperes and 6.83 amperes should be the amperes through X, which equals 7.80 amperes, or our answer to (i). The other method is by Ohm's law (A = V/O). The volts across X we found to be 21.07 volts, the ohms we found to be 2.75, the 21.07 ÷ 2.75 or 21.07/2.75 = 7.63. (You will note there is a difference of .17 on account of not carrying our problem out to enough decimal places).

In answer to question (j) we have already found the volts to equal 21.07 volts.

ASSOCIATED EARNINGS ON INCREASE

Earnings of the Associated Telephone Utilities company continue to show improvement over last year, according to figures made public recently by Marshall E. Sampsell, president of this unit of the Insull group of utilities.

Consolidated gross earnings of the company and its subsidiaries for the quarter ended June 30, last, including earnings of subsidiary companies from dates of acquisition only, were $4,382,065, compared with $3,943,865 in the comparable 1930 period.

Net earnings were $2,043,722, compared with $1,785,827, and net income, after all charges except depreciation, was $710,765, against $685,122. Because the net income is computed before deduction for depreciation, earnings per share cannot be figured.

For the twelve months ended with June, gross earnings were $16,511,893, compared with $13,629,347 the year before and net earnings were $7,521,221, against $6,140,395. Net income after all charges but before depreciation was $2,760,485, compared with $2,480,945.

McCOOL HAS NEW COPPER TOLL LINE

Workmen from the Lincoln construction department of the Lincoln Telephone & Telegraph company, Lincoln, Neb., have completed the extension of a copper toll line from York to McCool, Neb., and with this improvement a superior form of long distance service is expected by York and McCool subscribers.

CONVENTION SCHEDULE

United States Independent Telephone Association, Hotel Stevens, Chicago, Oct. 20, 21, 22 and 23.

Independent Pioneer Telephone Association of U. S., Hotel Stevens, Chicago, Thursday, October 22.

Illinois Telephone Association, Pere Marquette Hotel, Peoria, November 18 and 19.

Characteristics of Strowger Relays*

Discussion of Features of Horizontal Relay Structure Which May Be Varied to Secure Different Performance Characteristics and Which Account for Long Life of This Type of Relay.

By K. W. GRAYBILL
Research and Development Department, Automatic Electric, Inc.

Certain relays in automatic switches must remain operated when their circuits are repeatedly interrupted. The interruptions to such relay circuits are commonly called pulses and are caused by the operation of the dial at the subscriber's telephone. Each "pulse" consists of an open period and a closed period.

The length of the open and closed periods is usually indicated by stating that the pulse provides a certain "per cent make period" meaning that the time of the closed period (make) is a certain percentage of the total pulse (sum of the open and closed periods). The performance of a slow acting relay which remains in its operated position during interruptions (pulses) to its circuit is measured by finding the lower per cent make (i. e., shortest length of closed period) at a given speed that will allow the relay to remain operated.

The speed of pulses must always be stated in connection with percent make values because the actual length of the closed period for a given value of percent make varies as the speed varies. The relays for which release and operate time values are given in Figure 5 were studied to select the proper size of copper slug or sleeve which would give the best performance during pulsing at dial speeds of 8 to 12 pulses per second.

The best performance in such a case is operation with the lowest percent make for all pulse speeds considered. Figure 6 records the performance for three sizes of slugs and three sizes of sleeves tested on this relay. Considering the copper slug relays first, it will be noted that the 11/16″ slug provides better overall performance than either the larger 1″ slug or the smaller 7/16″ slug. The .500″ sleeve diameter sleeve provides better over all performance than the larger .562″ sleeve or the smaller .437″ sleeve. The .500″ sleeve requires only about 25 to 27 per cent make compared with 31 to 32½ per cent make for the 11/16″ slug at speeds of 8 to 12 pulses per second. The .500″ copper sleeve relay is therefore being used in this particular application because its performance is definitely superior to all other combinations tested.

The ability of coils to dissipate energy on continuous operation depends on the temperature the insulation will stand. Experiment has proved that enamel insulated wire in horizontal relay coils will safely dissipate 1.5 watts per square inch of coil surface. Single silk insulation of coil wire permits the coils to safely dissipate 4.5 watts per square inch. A horizontal relay coil has approximately 8 square inches of area when wound full and full coils will therefore dissipate 12 watts with enamel insulated wire and 36 watts with silk insulated wire. The value of watts for any given coil is obtained by dividing the maximum operating voltage by the total resistance in the coil circuit which gives the current through the coil; and by squaring this current value and multiplying the result by the resistance of the coil.

The durability of the horizontal relay mechanism has been demonstrated in telephone apparatus throughout the world, in Automatic Electric Inc.'s development and research laboratory, and in customers' laboratories. After 10,000,000 operations with average spring loads and adjustments, there is so little wear on the moving parts of a horizontal relay, that it has practically no effect on operation.

There is some tendency for the residual screw to wear rapidly at first due to its small area of contact and the adjustment of this screw may change as much as .001″ during the first 1,000,000 operations but thereafter should wear not more than .001″ during about 5,000,000 operations. With the spring adjustments considered as standard for this type of relay there is no noticeable change in spring pressure and no breakage or sign of fatigue for many millions of operations. Contacts will wear, of course, either from friction or from arcing or both, and will need readjustment occasionally. One customer reported 25,000,000 operations in his laboratory test of these relays with no trouble or failure.

Contact durability depends largely on the load broken by the contacts. With 50 volt loads of less than a half ampere, a comparatively inexpensive alloy of silver and gold is used which gives a very satisfactory life. With loads from one-half to one ampere, contacts of platinum or its equivalent in performance are used. If loads greater than one ampere are to

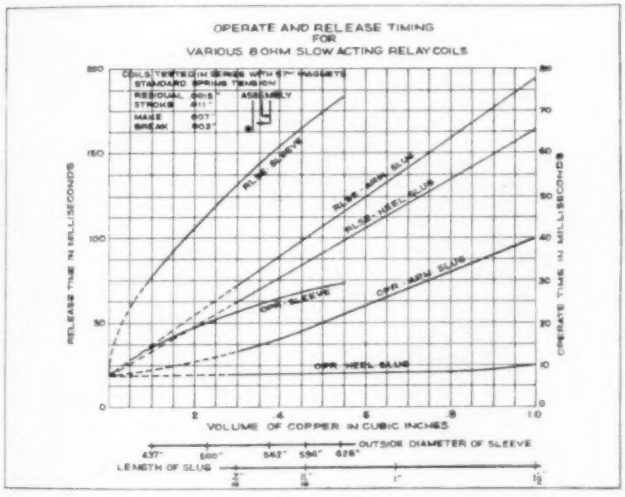

OPERATE AND RELEASE TIMING
FOR
VARIOUS 8 OHM SLOW ACTING RELAY COILS
RELEASE TIME IN MILLISECONDS
OPERATE TIME IN MILLISECONDS
VOLUME OF COPPER IN CUBIC INCHES
OUTSIDE DIAMETER OF SLEEVE
LENGTH OF SLUG

Figure 5

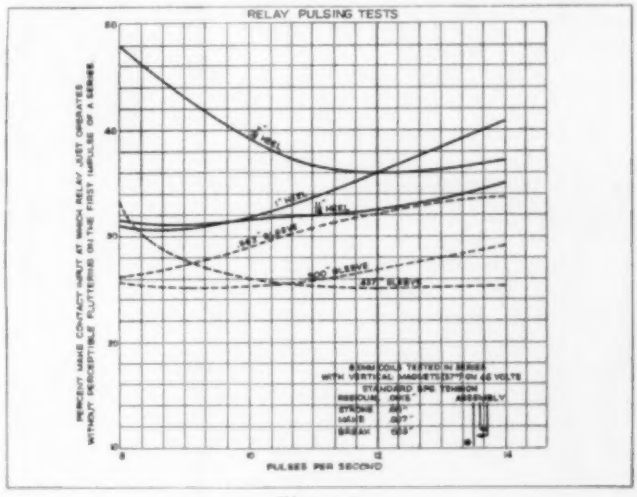


Figure 6

*Editor's Note: This is the second half of article 4 of a series by Mr. Graybill dealing with relay characteristics. Article 5 will appear in the next issue.

be broken, either other metals may be used or parallel-series connections of springs may be used instead of allowing the load to be broken by only one pair of springs. For example, it is possible to break a five ampere 110 volt load with three series groups, each consisting of two pairs of make contacts in parallel, for over 1,000,000 operations, without contact failure.

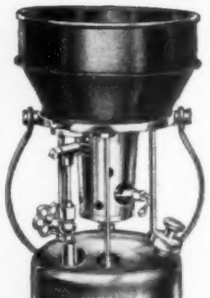
Adjustments for relays which break heavy loads are specified so as to provide continued operation as the contacts wear away from arcing. The usual requirement provides that each contact in a pair may wear away one-half its height before there is danger of the contacts failing to close. The necessity for this kind of a requirement must be considered at the time the make contact adjustments are selected to give desired contact pressure. When contacts are to close circuits in which currents of one to five amperes are flowing, it is desirable to have contact pressures of 50 to 100 grams in order to avoid excessive heating of the contacts.

Durability of coils is influenced by circuit conditions, climatic conditions and the quality of materials entering into the construction of the coil.

It is desirable to use enamel insulated wire for coils because of its lower cost and because of the comparatively large number of turns which can be wound in a given space. However, on small wire sizes (No. 38 to No. 40 B&S gauge) there is some tendency for an occasional shorted turn to occur with enamel insulation. If shorted turns are a serious handicap to certain circuit conditions enamel insulation should not be used on the small sizes of wire. Single silk insulated wire is practically free from shorted turn trouble but costs more and takes more winding space than enamel insulated wire. Occasionally some unusual conditions must be met such as extreme conditions of humidity or high operating voltage which make it advisable to specify either enamel and single silk together or double silk insulation.

Corrosion within the windings of coils is due to electrolysis which can only take place when there is considerable moisture in the coil. Exhaustive tests in laboratory humidity tanks in which conditions of high relative humidity are maintained, have been conducted during recent years on hundreds of sample coils representing a multitude of variations in materials and manufacturing processes. During these tests the materials which are now in use in standard coils have been proved to be equal to the best commercial materials available for this purpose.

The knowledge gained during such tests about the performance of various materials and practices, provides definite technical guidance when coils must be designed to meet special conditions. One of the improvements introduced as the result of these tests was a method of impregnating interleaving paper which gives increased coil life under conditions of extreme humidity and assures more uniform impregnation of paper. Processes of impregnating coils to seal them against humidity have also been developed to meet special conditions. It is important in guarding against corrosion of coils under extreme conditions to arrange circuits so that coil windings are always connected to the negative battery potential as the destructive corrosion which takes place as the result of electrolysis is at the positive pole of the circuit.



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UNITED SERVICE TO REACH TO THE ATLANTIC

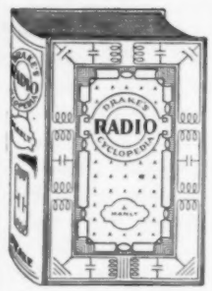
The New Jersey Telephone company, serving more than 2,000 telephones in that state, has just been purchased by the United Companies, with headquarters in Abilene, Kans., which organization owns numerous telephone and electrical companies. The New Jersey company has exchanges that are well located to serve newly opened suburban territory near New York.

The United Companies also recently purchased the Cumberland Telephone company of Pennsylvania and the Interstate Telephone and Telegraph company operating in Ohio and Indiana. Now, with the addition of the New Jersey Telephone company, the United Companies provide telephone service in an unbroken series of states from Colorado eastward to the Atlantic seaboard.

OHIO CITIES NOW HOLDING ADD-A-PHONE CONTEST

Seventy-five employes of the Ohio Cities Telephone company, representing ten exchanges, met recently to formulate plans for an Add-A-Phone campaign to take place during the month of September. Every telephone employe has turned into a salesman during the contest.

Similar campaigns have been held elsewhere over the country during the past year with considerable success in stimulating business. District and local prizes based on a point system will be given to winners in the contest.



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[A. Parlett, Jr., Manager, Switchboard Sales Department, Kellogg Switchboard and Supply Company, Chicago, Here Tells of Telephone System Carried on World's Largest Airship]

A flying telephone system, nearly three city blocks long, equalling in efficiency and number of instruments the equipment found in an apartment house, is installed in the U. S. S. Akron, world's largest airship, recently completed at Akron, Ohio, for the United States navy.

The Kellogg Switchboard and Supply company, of Chicago, working in close co-operation with the navy and Goodyear-Zeppelin engineers, handled the complete details of designing and manufacturing the entire system including the switchboard, telephones, cable and all accessory equipment for the new navy airship built by the Goodyear-Zeppelin corporation.

The system includes seventeen separate telephones, located at strategic points from the bow to the stern of the Akron, which will provide communication between all parts of the ship. When the craft is moored, a line may be plugged into an outside system, allowing local or long distance calls to be made directly from the ship.

The necessity for weight conservation was responsible for use of aluminum and aluminum alloys wherever possible in building the system and as a result its total weight, including the seventeen instruments, switchboard and three miles of cable, has been reduced by Kellogg and Goodyear-Zeppelin engineers to less than 250 pounds. Weight of a similar installation in an apartment house is more than 400 pounds.

The Kellogg Switchboard

The switchboard is located in an opening in the bulkhead between the control room and the chart room and may be operated from either room. The switchboard box, which is gas tight, is made of welded aluminum. There will be no aerial "hello girl" on the ship, as the officer of the deck or the junior officer of the deck will operate the board as a part of their routine duties. Needless to say, the system will be "for business calls only."

The board will handle three separate conversations at once, but should additional calls come in it will be necessary to interrupt one conversation. Power for the system is provided by a 24-volt circuit from the generator room.

When the ringing key on the switchboard is pressed, a musical sound—approximately the key of C, which experts say is more audible than any other—issues from the instrument to which the call is going. If desired, all instruments may be "rung" at once, and the sound used to transmit code messages throughout the ship. Should the captain of the Akron desire to speak to all 'phones at once, he may do so, issuing general orders to every strategic point.

Station Locations

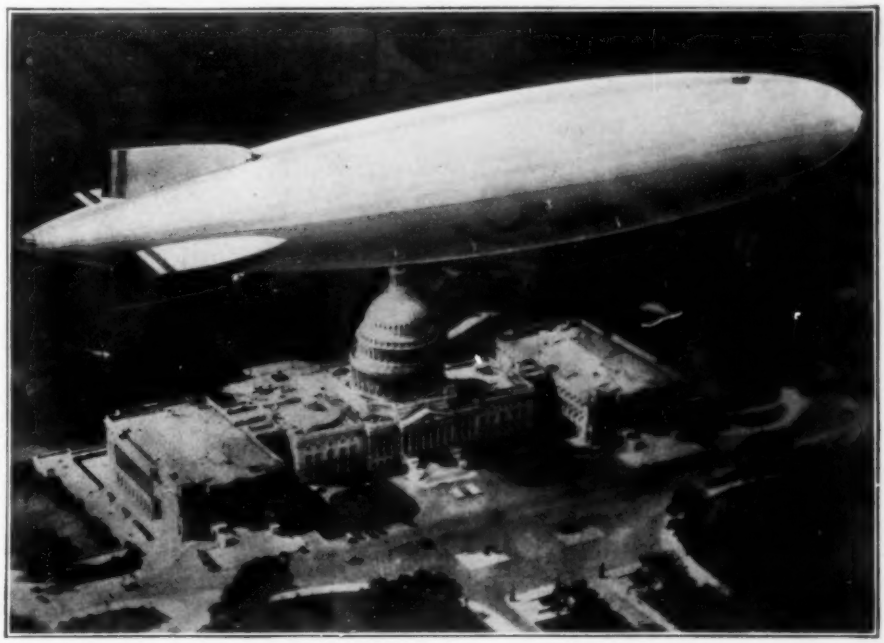
Running from the officers' quarters above the control room, to the bow, is a gangway in which three 'phones have been installed. The first is a general utility instrument serving the officers' quarters. The next is further up the gangway toward the bow and is located adjacent to important fuel valves, while the third is in the bow itself and is very necessary during a mooring operation. Also running up the forward gangway is a line which may be attached to an outside city circuit after the Akron has been moored to a mast, making the ship's installation a part of the local telephone system. On the top of the Akron will be observation and gun platforms and telephones are, of course, provided near each of these.

Extending along each side of the ship are lateral gangways and several instruments have been placed in these gangways. Telephones are located approximately 35 feet from the engine room on each side, so that it is a matter of a comparatively short distance from each engine compartment to a telephone. Orders from the bridge to engine rooms are conveyed by a "marine telegraph" system similar to that in use on surface ships, rather than by telephone.

Telephones are to be found in the gangways outside the officers' and crew's quarters, in the generator room, in the airplane compartment, in the observation and gun platform in the extreme stern, and in the auxiliary control station in the lower vertical fin. Provision is made in the auxiliary control room for plugging in a line leading to a headset to be worn by a man on the ground, who can assist the captain during ground maneuvers.

Telephone Instruments and Cable

The instruments are similar in appearance to the small square type sometimes seen in factories. The switches are gas tight and the telephone box is suspended by springs from its four corners to prevent any interference by vibration. Instead of one earphone, as in the usual equipment, two are provided and they are fitted with rubber cups which shut out extraneous noise while in use. Special circuits have been provided for other types of 'phones which may be installed by the navy if desired.



Artist's conception of the Kellogg-equipped U. S. S. Akron in full flight over the capitol building at Washington.

Cabling the Akron

The telephone cables in a Zeppelin present difficulties not encountered in any other type of telephone installation. Kellogg designers were confronted with specifications for conductors of low resistance and extreme lightness, without tendency to crystallize and break under vib-

ration, without soldered joints and with an overall metallic braid for mechanical protection and shielding against static and radio interference.

In the design of such cable, terminal or junction boxes are eliminated to the greatest possible extent because of the weight element. Splices are frowned upon on account of vibration and consequent possibility of crystallization and open joints. It is therefore almost a necessity to make up all of the cable for any one section of the ship in one complete harness without splices but completely armored with all taps brought out at the proper stations and of the right length.

For conductors a No. 20 B&S gauge equivalent stranded bronze wire was chosen. Over this a thin wall of rubber was applied and then a closely-woven braid of cotton. For further moisture protection, twelve coats of lacquer were applied to the braid, each coat being thoroughly dried before successive coats were applied. The conductors thus completed were twisted into pairs and laid in place. Where the junctions would otherwise be tapped out to each station the uncut pair was simply turned out of the main cable and cut to the length necessary to reach the specified telephone. Thus was laid out a harness much like the harness connecting generator, spark plugs, battery and other electrical apparatus in your car, but on a gigantic scale.

Over this harness a cotton braid was applied and made impervious with twelve more coats of lacquer. For shielding, a network of fine aluminum alloy wire was braided over the entire cable giving it a flexible metallic armor of extreme lightness and strength.

The armoring of a cable of uniform diameter without branches is a simple affair but a cable constantly decreasing in diameter with branches extending out like a Christmas tree and without splices presents manufacturing difficulties of no small proportions.

Five cables make up the telephone network of the Akron. From the switchboard one main cable leads out 25 feet to the only telephone junction box on the airship.

One cable leaves the junction box with nine pairs and connects to the telephones located along the port gangway. From this cable pairs also branch out to two telephones located in the top gangway and to one instrument in the airplane compartment in the bottom. The longest pair in this cable is 760 feet and serves an instrument at the stern station.

Another cable of seven pairs extends along the starboard gangway serving telephones along this passage and one telephone in the generator room. The longest pair in this cable is 530 feet.

Another three-pair cable runs forward to the bow with one intermediate station, and a short single pair serves a telephone in the bow walk-way.

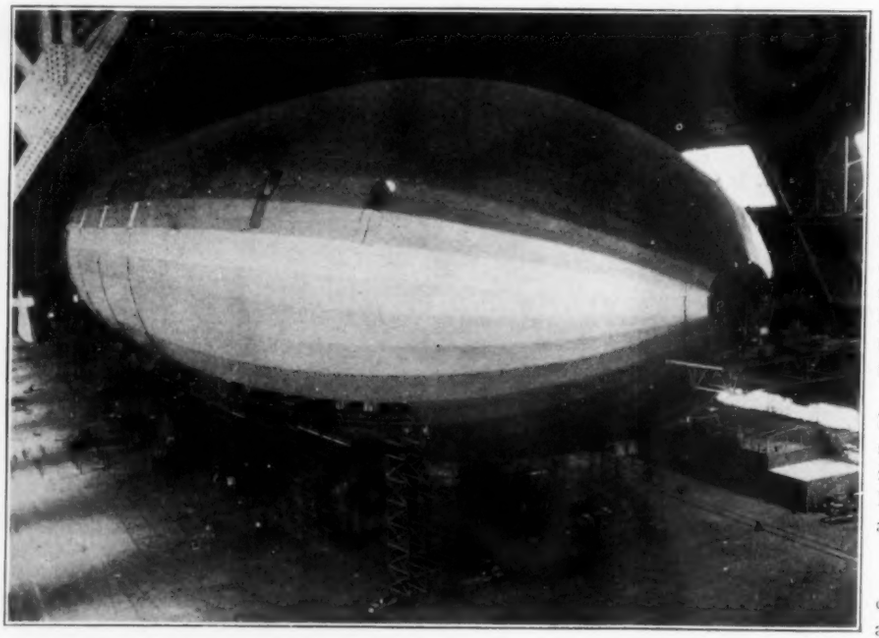
The New Navy Airships

The new American navy ships, "The Akron" and ZRS-5, authorized by Congress, the first of which has been completed at Akron, are to be not only the largest but the fastest and strongest airships ever built.

It is well known that every Zeppelin ship has a keel or backbone, its major longitudinal strength member.

However, "The Akron" will have three such keels instead of one. Some idea of the increase in strength may be realized by the simple illustration of lashing three lead-pencils together and trying to break them, as compared to breaking a single pencil.

One of the many specially built Kellogg telephone sets installed aboard the new ship. Double receivers with rubber cup attachments help eliminate extraneous noise and assure good reception.



Putting on the outer covering of the U. S. S. Akron inside its mammoth dock. It was at this stage of construction that the Kellogg telephone system was installed.

The keel of an airship is built large enough to obtain a gangway or cat-walk running from one end of the ship to the other, giving accessibility throughout the ship, offering space alongside for fuel, ballast, passenger or crew quarters, baggage and mail compartments.

The new American ships will retain this gangway feature, but by placing one of these gangways at the top of the ship and the other two at 45 degrees from the bottom, the accessibility to service facilities and to maintenance are more than tripled.

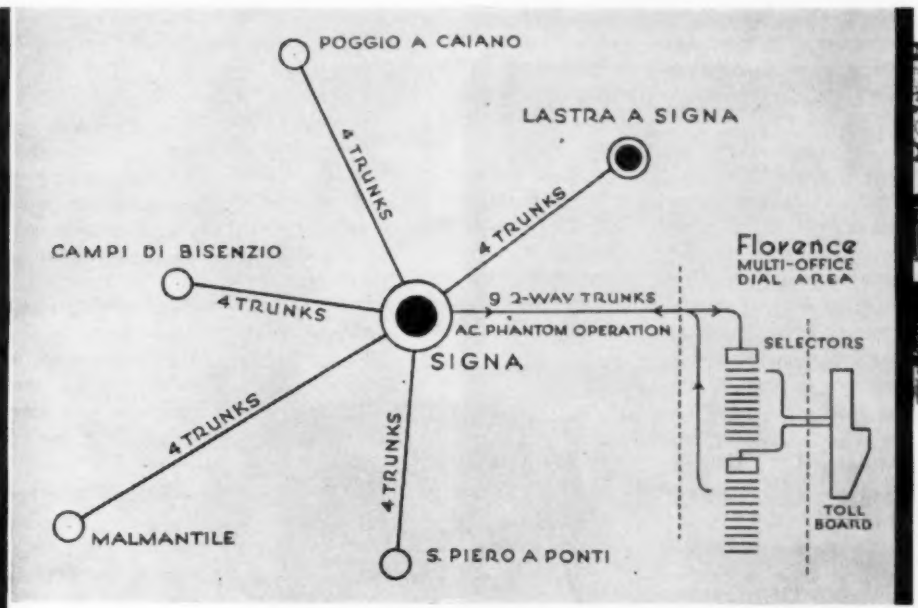
Since a gas leak, if one occurs, can be repaired in flight, the value of constant inspection of every part of the ship is a safety factor of great importance. No Zeppelin has ever been so completely accessible to inspection as these will be.

Valves

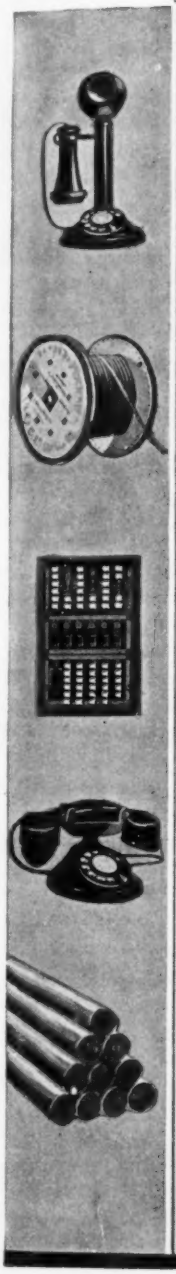
For example, any gas expands and contracts due to changes in temperature, altitude and barometric pressure so that valves are provided on all lighter-than-air craft, in case expansion should reach the maximum capacity of the bag—when the surplus is released through the valves immediately and automatically without bringing any strain on the ship.

Construction Features

The Goodyear-Zeppelin corporation evolved a new type of main frame. These are of triangular cross section, each being built inherently strong, without the great network of (transverse structural) wir-



SIGNA, ITALY, DIAL NETWORK



Modern Telephone Practice Reflected in Signa Strowger Automatic Network

THE Signa dial network covers an important area of the Florence, Italy, telephonic district, which is operated by the Societa Telefonica Tirrena. This company has introduced an original and very modern system (T. E. T. I. System), dividing into several districts their entire operating zone, which stretches along the western coast of Italy, including such famous and important cities as Genoa, Pisa, Florence and Rome, all dial operated. The system requires dial operation throughout the districts, and this is rapidly being introduced even in the smallest communities. Long distance calls are completed by means of direct dialing through the toll operators of each district in accordance with a universal numbering plan which covers the entire zone.

The latest developments, using alternating current at commercial or voice frequency, have been utilized for dialing and supervision over long cable lines equipped with vacuum tube repeaters or arranged for phantom operation.

Strowger Automatic Dial equipment has been selected by the management of the Societa Telefonica Tirrena for its reliability and for its adaptability in meeting local requirements. This equipment is engineered, distributed and installed by The Automatic Electric Company, Ltd., a world-wide organization, which also handles other equally well-known telephonic and signaling products. Whatever your equipment requirements may be, write us for quotations before purchasing.

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Automatic Telephone Manufacturing Co., Ltd., Liverpool
The New Antwerp Telephone and Electrical Works, Antwerp
Eugene F. Phillips Electrical Works Limited, Montreal

ing used in previous types, a spider web of wire netting being used between gas cells merely as bulkheads and designed so that they cannot catch in the cell or chafe against it.

Strengthening of the ship permitted another improvement. Up to 1919 most control cars and all power cars were suspended on outriggers outside the body of the ship. Early ships usually had one engine mounted in the rear of the control car. And since all ships were hydrogen-inflated, it was necessary to get complete ventilation, to prevent the possibility of sparks from the engines coming in contact with the lifting gas.

In the "Los Angeles," however, the engine was omitted from the control car and the control room was built integrally into the hull of the ship.

The "Akron" takes the next step forward and for the first time in history places the engines inside the ship. The cutting down of resistance is obvious. Also the cramped quarters of power cars which were made as small as possible to cut down air resistance, give way in the new ships to comfortable engine rooms.

The use of helium permits this to be done with entire safety and the stronger framework absorbs the load as a part of the ship.

Another improvement brought out in the "Akron" is the device of swiveling propellers. These can be swung in a 90-degree arc, and since the engines are reversible, give the ship vertical thrust, down or up.

The swiveling feature will be valuable in maneuvering the ship, especially in landings and take-offs. Pointed downward to exert a vertical thrust this will enable a ship to take off "heavy," carrying additional fuel and so increasing the cruising radius. They can be used also to drive the ship downward if it comes in for landing "light," due to atmospheric conditions or other causes.

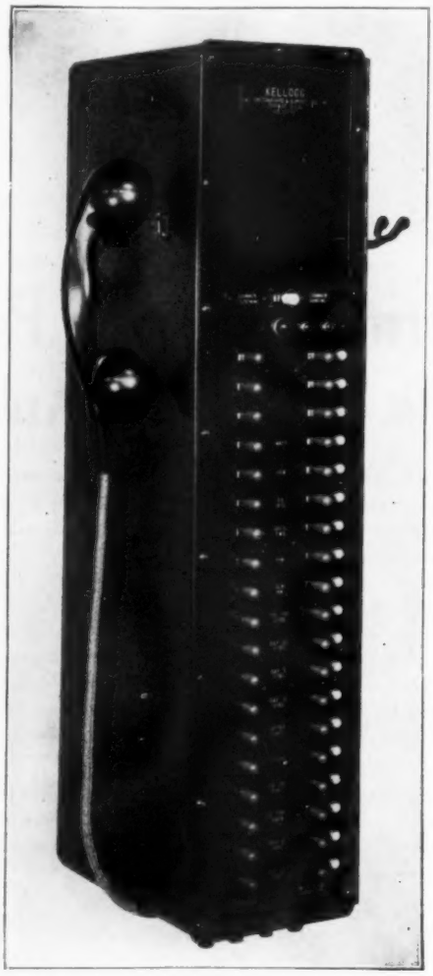
Carries Five Airplanes

One of the most interesting of the improvements in the "Akron" is the airplane compartment, where space for five airplanes is provided in the hull. This storage "hangar" is 75x60 feet in size, and is located about one-third of the ship's length from the bow. Planes may be released through a T-shaped opening in the ship's bottom by a trapeze arrangement while the ship is in flight. They may be picked up again on the trapeze, and hauled into the compartment by a winch. Such a provision increases the scouting value of a naval airship and aids her in warding off attack.

Building the Airship Dock

Because of its unusualness, a few words regarding the dock itself may prove interesting. The dock in which the "Akron" is being constructed, at Akron airport two miles from the Goodyear factory, half a mile from the Goodyear-Zeppelin shops, is the largest and perhaps the most unusual building of its kind in the world. As a piece of engineering it is little less interesting than the airship built under its massive dome, and so has attracted hundreds of thousands of visitors.

One delicate part of airship operation is that of taking the ship in and out of the dock in a cross wind. So it is important that the building should cause the least practical interference with wind currents in order that these operations



This unusual, compact switchboard was designed by Kellogg engineers for the world's largest airship. A Masterphone handset is used because of its unusually high transmission and reception qualities.

may not be complicated by cross currents created by the building itself, or by the open doors.

It was this consideration which, after elaborate wind tunnel tests, conducted by the Guggenheim School of Aeronautics, New York University, and elsewhere confirmed the judgment of Dr. Arnstein, who, with his staff, developed the basic design in fixing the shape of the structure—approximately a semi-paraboloid.

The orange-peel-shaped doors, weighing 600 tons each, follow the contour of the building in opening and closing and are attached to a single six-foot pin at the top and roll on 40 wheels, assembled on four-wheel trucks, riding on a circular track.

The building, 1,175 feet long, 325 feet wide, and 211 feet high, is the largest structure in the world without interior support. Seven football games could be played simultaneously under its roof, six miles of standard railroad track could be laid on its eight and one-half acres of floor, 100,000 people could gather within its walls, the "Lexington" and "Saratoga," the great airplane carriers, could be housed there, the Woolworth building could be laid lengthwise inside and the Washington monument added alongside it and there would still be ample room.

Tunnels have been built under the concrete floors for service facilities and for the docking rails, which will be used for moving the ships in and out of the structure. All service facilities, power, light, water, helium gas are brought into the building underground.

Since the 7,200 tons of steel in the framework expand and contract with changes in temperature, the arches of the building are placed on rollers, so that the giant building may be said literally to breathe.

Several working platforms, lowered from the roof, give the workmen access to the ship, and a series of six catwalks along the underside of the curving roof make the upper reaches accessible. An inclined railway, the cars being counterbalanced, carries the workmen to the stations aloft.

The building was so large that it seemed useless to attempt to heat it except in offices and shops. Portable electric heaters were devised for working platforms in cold weather.

Adjustable projectors of 1,000-watt lights are located along the catwalks at levels of 65 feet up to 150 feet.

The building is so huge that Mr. Ripley in his "Believe It or Not" feature says that sudden temperature changes cause clouds to form inside the dock and water falls.

All in all, the U. S. S. "Akron" and the dock are both marvelous accomplishments which every one of us can be justly proud of. We, at Kellogg, take great pleasure in the part that the Kellogg Switchboard and Supply company enjoyed in equipping the ship. We are glad that the Goodyear-Zeppelin corporation gave us this opportunity to prove again the excellency of Kellogg equipment and the greater wisdom of Kellogg design under any and all conditions.

The high tension electric line from the Oklahoma Gas and Electric company's plant to wells at Alva, Okla., has been completed.

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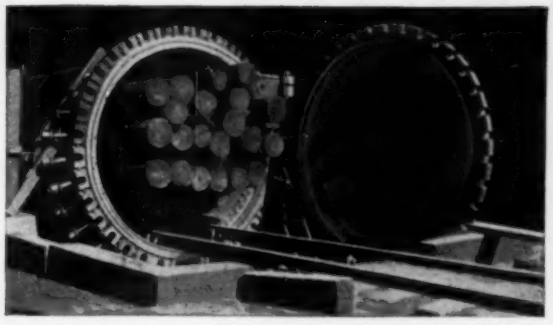

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STRESSES IN GUYING

Specifications usually provide for anchors to be placed the length of the pole out of the ground away from the pole; this gives us an angle of 45 degrees between guy and ground (Fig. 1).

Considering the pull of the wires, to be effective at the point where the guy is attached to the pole, we have three forces acting at that point—the pull of the wires, the tension of the guy, and the resistance of the pole to the compression.

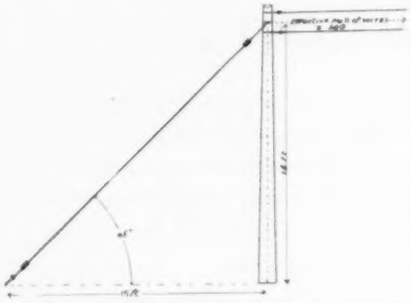

Fig. 1

Let us analyze these three forces, see how they are proportioned and how we may keep them reasonably within the limits of strength of their respective parts.

The proposition of the triangle of forces states that "When three forces acting on a point are in equilibrium they may be represented by a triangle whose sides will equal in magnitude and direction those three forces."

Constructing our triangle (Fig. 2), we find the compression on the pole to be

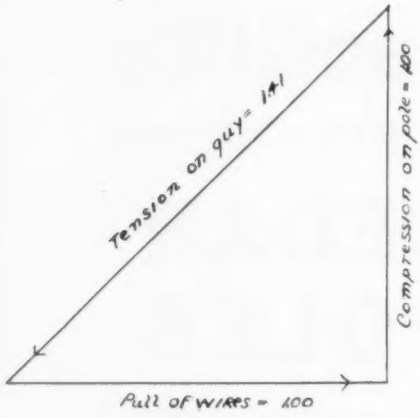

Fig. 2

equal to the pull of the wires, and the tension on the guy to be 1.41 times as much. Comparing this triangle with Fig. 1, we find them alike; the distance of the anchor from the pole representing the pull of the wires; the length of the guy its tension; and the distance from the ground to where the guy is attached to the pole, the compression on that member.

This holds true with any anchored pole; we have to divide the distance of the anchor from the pole into the length of the guy to find its strain factor, and likewise with the pole; thus a guy running from an anchor 3 feet from the pole to a point 15 feet up the pole would be 15.3 feet long; this divided by 3 gives 5.1, so the strain on this guy is 5.1 times the pull of the wires; the compression on the pole is 15 divided by 3 equals 5 times the pull (Fig. 3). We can see from this how important it is to keep anchors away from the poles. Table 1 gives us the factors for different angles of guying.

So far we have been considering our pole as perpendicular, but our triangle shows us that if we can shorten the guy without changing the other sides, we can reduce the strain on it; by constructing our triangle for different degrees of rake (Fig. 4) we find the tension on the guy to vary from 1.41, when the pole is perpendicular, to 1.00, for a rake of 7 feet 6 inches; the stress on the pole is not affected. Table 2 gives these factors. Of course, a rake of 7 feet 6 inches is not usually used in practice, 2 feet is about standard, so in Table 3 we have a summary of our investigation, taking a 20-foot pole raked 2 feet with anchors at various distances.

TABLE 1

RELATIVE STRESSES ON GUYS AND POLES
(Pull of wires equals 1.00; pole perpendicular)

Angle of guy	Stress on guy	Stress on pole
25	1.10	.46
30	1.15	.57
40	1.30	.83
45	1.41	1.00
50	1.55	1.19
55	1.74	1.42
60	2.00	1.73
65	2.36	2.14
70	2.92	2.74
75	3.86	3.73
80	5.70	5.67

TABLE 2

RELATIVE STRESSES ON GUYS AND POLES
EFFECT OF RAKE

(Distance of anchor from pole, equals distance from ground to where guy is attached to pole, equals 15 ft. Pull of wires equals 1.00)

Rake	Stress on guy	Stress on pole
0	1.41	1.00
1′	1.36	1.00
2′	1.13	1.00
3′	1.27	1.00
4′	1.21	1.00
7′6″	1.00	1.00

TABLE 3

RELATIVE STRESSES ON GUYS AND POLES
(Height of guy on pole, 15 ft.; rake 2 ft.; pull of wires equals 1.00)

Distance of anchor from pole	Stress on guy	Stress on pole
2′	7.11	7.14

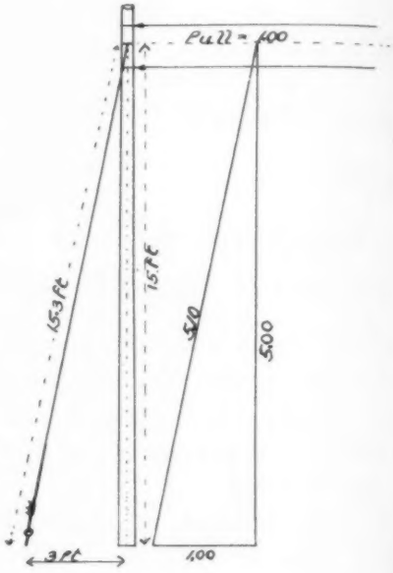

Fig. 3

3′	4.74	4.76
4′	3.70	3.70
5′	2.89	2.86
6′	2.53	2.47
7′	2.26	2.17
8′	1.98	1.85
9′	1.82	1.66
10′	1.68	1.50
12′	1.50	1.27
14′	1.35	1.06

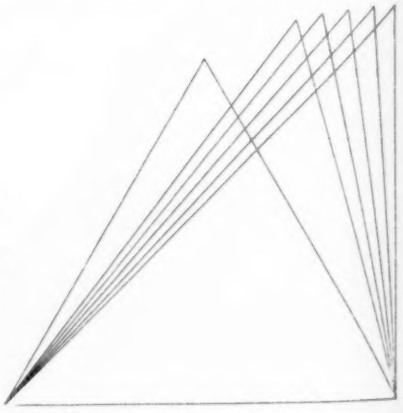

Fig. 4

15′	1.31	1.00
16′	1.27	.94
18′	1.20	.83
20′	1.16	.75

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RAILROAD PROGRAM CALLS FOR CONDUIT

The National Fireproofing corporation has just received orders for approximately 300 miles of underground clay conduit for housing signal and communication cables involved in the electrification of the Pennsylvania Railroad lines, between New York and Washington.

This notable undertaking has just been broadened to extend from Wilmington, Dela., on to Washington, D. C., with indications that the work will be pushed rapidly to completion.

Production and shipping of the conduit has already commenced, and will put a great many additional men to work in both the manufacture and installation of this material.

TELEPHONE MEN REPORT ON VISITS TO EUROPE

Warren Safford, owner of the Troy Telephone company, Troy, Ohio, and former president of the Ohio Independent Telephone association, who is touring Europe with Mrs. Safford and their daughter, was last heard from at Interlaken, Switzerland. He wrote: "Get your grip packed for the 1932 Pioneer's trip. You can't afford to miss it. The Alps are grand!"

P. Kerr Higgins, president of the Scotia Telephone company, St. Louis, Mo., has recently returned from a three months' tour of European countries.

IMPROVEMENT FOR RISON EXCHANGE

Work has begun on rebuilding the Southwestern Bell Telephone exchange at Rison, Ark. In addition to new poles, cables and wire, complete new office equipment will be installed, including a new switchboard. The central office will be moved in a new building now under construction.

Cost of the improvement will exceed $10,000, and will include replacement of 64 poles, 7,767 feet of new cable, 300 feet of underground cable and more than 10 miles of new wire.

NEW YORK TELEPHONE SHOWS INCREASE

For the first month since January, the New York Telephone company reports for July an increase in gross operating revenue compared with the corresponding month of 1930, the figure being $17,456,513, against $17,361,104, as reported to the Interstate Commerce commission. In the months from February to June, inclusive, gross revenues were below those for the corresponding months of last year. Net earnings for July were $3,625,258, against $3,250,998, after operating and maintenance expenses, taxes and depreciation.

February was the only month so far in 1931 that showed lower net earnings than in the corresponding months of 1930. As a result, gross operating revenue for the first seven months of 1931 was $124,143,699, against $124,297,360, a decline of $153,661, or 0.12 per cent, while net operating income was $27,480,135, against $25,164,548, a gain of $2,315,587, or 9.2 per cent. The net improvement of $2,469,248 over 1930 is equivalent to 2 per cent of gross revenue.

At a meeting of the directors of the New England Telephone and Telegraph company held in Boston on August 18, a dividend of $2 per share was declared, payable on Wednesday, September 30, 1931, to stockholders of record at the close of business on Thursday, September 10, 1931.

Bell Telephone Company of Canada, Ltd., has declared the regular quarterly dividend of $2, payable October 15 to stock of record September 23.

INSTALL UNDERGROUND CABLES AT ATHENS

There has been no indication of a business depression in Athens, Ohio, if the Athens Home Telephone company is to be considered in any way representative of business conditions.

And this telephone company is so considered by the leading bank of Athens, the Athens National Bank, which recently ran an advertisement pointing out the stability of Athens, in which the increasing growth and progress of the telephone company was told, as indicative of the business situation in Athens.

To quote from the advertisement which appeared in an Athens newspaper:

"Being more local in character perhaps than any other Athens institution, the Home Telephone company has made a consistent endeavor for more than 30 years past to give its telephone using patrons the very latest and most effective service.

"Athens is the hub of a county system of telephone arteries for the bringing in of orders to its wholesalers and business institutions.

"Many of its 175 stockholders made a sufficient investment so that the dividends on same take care of the cost of their service.

"For many weeks past workmen have been engaged in extending the underground system beneath more of the better streets. Each year cables are installed therein which tend to improve and stabilize the service during stormy times. Eventually Athens will have a comprehensive underground systems."

No slowing down of business is evidenced by this carload of cable unloaded at Athens, Ohio, for further construction work on the part of the Athens Home Telephone company.

EXPERTS DEVELOP SINGLE SIDE BAND

An important advance in the perfection of short wave single-side band radiotelephony has been demonstrated successfully recently at the radio station of Le Materiel Telephonique at Trapes, near Paris, by the company's engineers in co-operation with the research engineers of the International Telephone and Telegraph laboratories, of Hendon, England, at the station of the National Telephone company in Madrid. A distinctive feature of the installation is a pilot wave which is transmitted solely for the purpose of keeping the distant receiver in tune with the transmitting station.

Single side-band radio-telephony takes advantage of the fact that only part of the ordinary wave is really essential for perfect reception, provided that the receiver is kept effectively tuned with the transmitting station. Inasmuch as frequencies of the order of 18,000,000 cycles a second are involved, tuning presents a different problem, but it has been solved by use of the pilot wave.

While short wave single side-band systems in general are not new the pilot wave system greatly improves the quality of transmission, reduces interruption, due to fading and atmospherics or interference from other stations. Nearly twice as many radio stations can be operated by the single side-band method than is at present possible without interference between them.

Lineman's
Bolt and Wire
Cutter
No. 114
Length 14 in.

THE bolt cutter that Linemen have been waiting for —an all-around cutter of tremendous power, yet so light that it can be easily carried in the belt.

Although only 14 inches in length, this new Vacuum Grip-built cutter easily handles wire and bolts up to 5/16 in. Does the work of heavy, cumbersome cutters that often hamper the lineman instead of helping him. Also ideal for heavy switchboard cables, storage battery lead straps, etc.

The only bolt and cable cutter with knives made of finest electric furnace Molybdenum alloy tool steel, *tempered to the core (not merely surface-hardened)*— and handles of hammer-forged alloy tool steel instead of cast iron.

Simple in construction—no "adjustment" nuts to fuss with. Cutters assembled as a unit can be quickly removed and replaced. Stronger and more durable than any cutter on the market. Guaranteed against defects in material and workmanship.

Also furnished in 24" size for cutting ½" bolts and heavy cable.

PURCHASING AGENTS: Order a pair of these cutters for inspection and try-out. Write for literature and prices on Vacuum Grip Lineman Pliers.

FORGED STEEL PRODUCTS CO.
Newport, Pa.

Made by the Manufacturers of

Vacuum Grip
REG. U.S. PAT. OFF.
Pliers

NEARLY A MILLION IN USE

SPEED..POWER

Unmatched Traction!

That's why the FWD is most flexible of trucks adaptable to your work

Public Utilities Companies are using Four Wheel Drive Trucks in large fleets because they handle every trucking assignment with the same dependability and economy of operation . . . because they have ample speed, and power, and traction, unmatched by ordinary trucks.

The FWD Utility Truck is exceptionally powerful — it puts all of the power developed to actual use—it drives and brakes on all four wheels—it pulls through the toughest of "road-going"— up and down hills —in and out of ditches—it is a powerful, economical, all-purpose utility truck, different in principle . . . The FWD Truck is used by 110 of the country's leading utilities companies. Some of these utilities have purchased over 100 FWD's for line construction and line maintenance. Let us send you bulletin describing this powerful, fast, economical FWD Utility Truck . . . Write today.

Write Department F

The Four Wheel Drive Auto Company
CLINTONVILLE, WISCONSIN
Canadian Factory: Kitchener, Ontario

FWD

BACKED BY NATION-WIDE SERVICE

News From the Field

King George has been presented with the two-millionth telephone connected with the British Post Office system. It has been installed in Buckingham Palace, is finished in gold, and bears a plate reading: "This instrument, installed for his Majesty King George V, is the two-millionth telephone connected with the Post Office system."

Two-way radio telephones have been installed in the tri-motored Ford planes of American Airways which opened the New York-Syracuse-Cleveland line this month.

Wired Music, a New York organization, has applied to the New York Public Service commission for a ruling as to whether the New York Telephone company shall be required to lease lines for transmitting audio frequency currents which can be converted to music in the home. The apparatus is waiting acceptance and a central studio has been planned from which vocal and musical programs are to be sent to homes over wires.

Dividends paid by telephone and telegraph companies in July amounted to $53,627,628, according to the Standard Statistics company, of New York. Total cash dividend payments made by domestic corporations in July were $516,095,367.

Formal opening of the common battery telephone service in the Western Telephone corporation exchange at Ness City, Kans., took place August 1.

Arguing that it "objected to being placed in the wire vending business," the New York Telephone company has refused service to an organization known as Wired Music. Wired Music plans to transmit musical entertainment to hotels and residences on a subscription basis.

Associated Telephone Utilities company has added the Home Telephone company of Wabash, Ind., to its list of Indiana telephone exchanges. The company was sold on a basis of $400,000. There was an indebtedness against the company of $14,000, making the purchase price, $386,000. The Associated Utilities company operates in 28 states.

August 1, the entire staff of the Bell Laboratories, Inc., went on a five-day week basis. This affected about 4,500 persons. There will be no change in the working basis of the remainder of the Bell System.

The Wisconsin Telephone company will begin work shortly on placing a submarine cable on the bottom of the Fox river at DePere, Wis. The cable, which will cost approximately $3,000, will connect with aerial cable on both sides of the river. The length of the under water span is 600 feet.

Exchanges at Wolcott and Goodland, Ind., have been purchased by the United Companies, a Kansas corporation which a year ago purchased other Goodland properties in Indiana.

The Churchill County Telephone and Telegraph company of Fallon, Nev., is installing a Kellogg 6-800 Masterbuilt switchboard which is equipped for 220 common battery, 70 rural, and 10 toll lines.

The Western Telephone corporation has started work on a construction program at the Ida Grove (Ia.) exchange, which is expected to require ten months to complete, and which includes new wires, poles, and underground conduits.

The Commonwealth Telephone company, Chilton, Wis., is investing $50,000 in telephone improvements, which will include selective harmonic ringing current.

The Mountain States Telephone and Telegraph company is extending cable lines in the western part of Gillette, Wyo., and is also stringing three blocks of 10-circuit open wire.

A telephone "bargain sale" was offered during August in 167 towns served by the Western Power, Light and Telephone company with headquarters in Salina, Kans., as a means of stimulating business. The sale was inaugurated near the first of the month and offered free service for the remainder of August for all new subscribers or on all new extension telephones.

The New York Telephone company is putting its wires between Syracuse and Watertown into the ground. A ditch-digging machine does the work. Chemists have built a covering for the wires which protects them from dampness and loss of power.

Utilities, Inc., a South Dakota corporation, has purchased telephone exchanges at Ree Heights, Faith, Harold, Isabel, Hoven, Dupree, Tolstoy, Eagle Butte, Seneca, and Onoka, all of South Dakota. The company has also purchased 17 exchanges in North Dakota which will be operated from the Fargo office.

The two Kansas telephone operating companies controlled by the United Telephone and Electric company are being merged. They are the Central Kansas Telephone company and the American Telephone company, which in the future will operate under the name of the American Telephone company. Fifty-five exchanges are involved in the change.

An underground conduit in Racine, Wis., which necessitated 2,200 feet of trench and expenditure in excess of $9,000 has been completed by the Wisconsin Telephone company.

The Illinois Commercial Telephone company is rebuilding lines between Toulon and Elmira, and in the Jug Run vicinity, northeast of Toulon.

The Rio Grande Valley Telephone company has just completed the erection of a one-story stucco over hollow tile building at San Benito and is starting the installation of its new switchboard which will be cut-over in October.

NO TELEPHONE MONOPOLY SAYS COMMISSION

The notion that the American Telephone and Telegraph holds a monopoly on the telephone business of the country is dispelled by the records of the Public Service commission, which shows that there are more than 350 independent telephone companies in New York State alone. Inquiry reveals that nearly all are prosperous and that all have the advantage of connection with the New York Telephone company for toll and long-distance connections, although the latter company alone belongs to the Bell System. What is true of New York is true also of the country at large. There are 7,163 private companies outside the Bell System in the United States, to say nothing of 29,281 connecting rural lines. A few of the independent New York companies are pretty big organizations, such as the Rochester Telephone corporation, the Northern New York Telephone company and the Black River Telephone Company, while others range down to small units, sometimes owned by a single individual or family, with a few score stations on their lines.—New York City Times.

Telephones that bring business

Stromberg-Carlson No. 1181 Hand Set Telephone

Stromberg-Carlson No. 1168 Desk Stand Telephone

Stromberg-Carlson No. 1177 Hand Set Telephone

There Is Nothing Finer than a Stromberg-Carlson

MOTION picture and word-of-mouth advertising have so popularized the hand set telephone that subscribers are actually demanding this instrument.

The fact that operating companies deem it advisable to make an additional charge for the rental of hand set telephones does not lessen the insistence of the public demand.

The operating company that strives to keep the transmission and reception efficiency of its service at the highest point meets this subscriber demand by installing the Stromberg-Carlson Hand Set Telephone.

This instrument, which is light, well-balanced, artistically designed and wired with the Booster Talking Circuit, is accepted as the instrument capable of meeting all subscriber demands.

Write for Bulletin 115.

Stromberg-Carlson Telephone Mfg. Co.

Pacific Coast Representative
Garnett, Young & Co.,
San Francisco, Cal.
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Branch Offices:
CHICAGO, ILLINOIS KANSAS CITY, MISSOURI TORONTO, CANADA

Southern Representative
Scoville Mercantile Company,
Atlanta, Ga.

Stromberg-Carlson

Identify your inquiry to advertisers by saying—"As shown in TELEPHONE ENGINEER"

Improving the Service at Nominal Cost

H. T. McCaig, Sales Engineer, Stromberg-Carlson Telephone Manufacturing Co., Here Tells How an Illinois Exchange Modernized Its Plant by Installing Efficient But Simple Equipment.

W. J. McQuiston, president of the Elmwood Telephone Exchange, formerly manager of the Monmouth Exchange, is one of the pioneers of Independent telephony in Illinois.

Despite the decided trend towards the adoption of common battery service in many of the smaller exchanges of the country, it is sometimes difficult to prove the advisability of such a move. Especially is this true where prevailing conditions in the community make any effort by the telephone company to secure an increase in rates, doomed to failure.

When a telephone company is faced with this situation, and yet desires to improve the plant and plant methods in order to maintain a high grade service, a careful study of the situation must be made.

The Elmwood Telephone company of Elmwood, Illinois, has recently solved such a problem by installing a Stromberg-Carlson 2-position No. 105 switchboard equipped with double lamp supervision cord circuits. Following the cutover to the new service the Elmwood Gazette gave the company a nice write-up on the editorial page, from which the following is quoted:

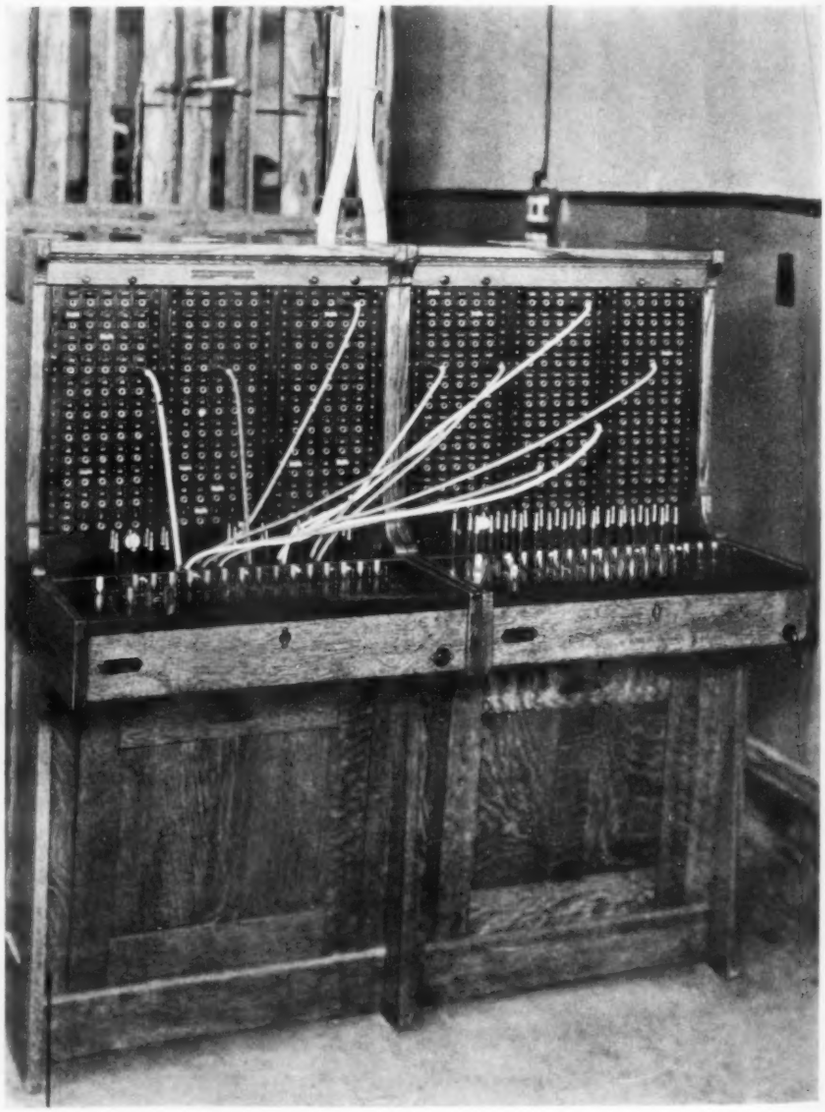
"In the late nineties the Elmwood Telephone company was organized by M. T. Lott and was operated by him for several years. Later E. M. Maher purchased the plant and built its present home. On January first, 1918, the McQuistons, W. J. and H. H., bought a controlling interest in the company from Mr. Maher and have since managed and operated the property. The company was incorporated as the Elmwood Telephone Exchange on February 14, 1919.

"Improvements have been made from time to time. A new ringing machine was added lately to the equipment and at present they are installing a new and up-to-date switchboard from which much is expected in the way of better service, especially in the matter of quicker disconnections. And right here we might suggest that subscribers can help the operators in this respect by being careful to 'ring off' every time after using the phone. On the new board this 'ringing off' lights a small light in front of the operator by which she knows that the subscriber is through with the line."

Manager McQuiston canvassed the situation quite thoroughly before deciding in favor of this particular type of equipment and has found the operation of the new board to fully justify him in his choice of apparatus.

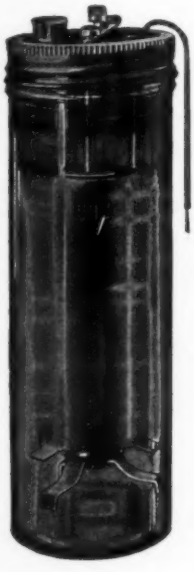
Incidentally, W. J. McQuiston, president of the Elmwood Telephone company, qualifies eminently as a telephone Pioneer. About 1890, when he was living in Monmouth, Ill., he bought two "phonetic" telephones, connecting them from his residence to that of his father about three blocks away. In 1892 the original instruments were replaced by two Bell telephones equipped with Blake transmitters. Later the line was extended to include other members of the family—six stations in all.

Mr. McQuiston's interest in the de-



Stromberg-Carlson 2-position No. 105 switchboard installed in the Elmwood, Illinois, Exchange.

The WATERBURY TELECELL



A dry, wet cell that is unequalled in its

ADAPTABILITY
TRUE ECONOMY
LASTING SERVICE
and
SATISFACTION

TRY IT AND SEE FOR YOURSELF

The Waterbury Battery Company
WATERBURY, CONN.

No. 91—1 Quart Patented Brass or Steel Tank Gasoline or Kerosene

SERVICE IN ALL WEATHER CONDITIONS

The recognized reliability of these torches and furnaces has won them wide popularity among telephone service men. However adverse the weather conditions are under which these men must work, they can always depend on the "Always Reliable" brand torches and furnaces. The differences, too, in Bernz construction make work easier, faster and more economical.

No. 32—1 Gallon Patented Kerosene-Gasoline Steel Tank—Brazed and Welded.

Order through your distributor or mail your order to us with your jobber's name.

Otto Bernz Co., Inc.
NEWARK, N. J.

Reduce Your Ringing Cost

Size 12"x9"x5"
Weight 15-lbs.

ONE MOVING PART!
ONE CONTACT!

IN WORLD-WIDE USE

TELERING

THE SUPER-RINGING MACHINE
MEETS ALL THE REQUIREMENTS OF GOOD RINGING SERVICE

Don't neglect consideration of the advantages of TELERING in P. B. X. service.

Its use will release the cable pairs now employed as ringing leads.

For isolated P. B. X.'s it is ideal.

Suitable for the largest Central Office or the smallest P. B. X.

POSITIVELY NO RADIO INTERFERENCE
OPERATED BY COMMERCIAL ALTERNATING CURRENT
INSTALL IT — THEN FORGET IT
Fully Guaranteed
Price $44.00 F. O. B. ELYRIA, OHIO
Sold by Leading Telephone Distributors

TELKOR, Inc. . . ELYRIA, OHIO

velopment of the telephone was such that he was one of the organizers of the Monmouth Telephone company in 1901, at which time the party line operated by the McQuiston family was connected with the Monmouth switchboard. In 1903 Mr. McQuiston was elected manager of the Monmouth Telephone company. Under his management such progress was made that in 1910 the Bell interests in Monmouth were purchased and the two competing systems merged. Following the merging of these two systems common battery service was inaugurated in Monmouth. Mr. McQuiston continued as manager of the Monmouth plant until January 1, 1918, when he purchased the Elmwood exchange and moved to that city.

Mr. McQuiston has always taken a keen interest in the development of Independent telephony and, as might be expected, the Elmwood plant reflects this interest and enthusiasm. H. H. McQuiston, who has been associated with his father in the development and improvement of the Elmwood plant, also deserves a great deal of credit for the service being rendered by this up-to-date system.

Book Review

Principles of Television, a complete study in television in one volume, by Farnsworth and Halloran. Cloth bound, 340 pages, more than 100 illustrations.

Purported to be the first complete and authentic study of television, this book was written by two recognized authorities, one of whom, Philo T. Farnsworth, is the actual inventor of television.

Those who want to know how and why television works, and the secret behind its sensational discovery, will find the answers in "Principles of Television." The invention, design, construction, operation and use of the cathode ray system of television, the system which will be used to bring talking pictures into the home by radio, is clearly explained.

All technical data is translated into understandable language. Each engineering problem is shown in its original form, and then repeated and explained in non-technical terms.

"Principles of Television" tell the reader what the inventor himself knows about this thrilling subject.

Useful Information About Lead. Published by Lead Industries association, 420 Lexington Ave., New York. Cloth bound, 104 pages, illustrated. Price $0.50 post paid.

This book tells concisely the story of lead and its principal uses, and should be of interest and practical value to every present or prospective user of lead and the multitudinous products derived from it. This refers to telephone men since lead is extensively used to protect cables from deterioration. The table of properties of lead published in this volume is probably the most complete and up-to-date ever published, including mechanical, thermal, electrical, optical and other constants.

INTERNATIONAL TO DOMINATE ERICSSON CO.

The International Telephone and Telegraph corporation will soon complete arrangements to acquire a dominant interest in the L. M. Ericsson Telephone company of Sweden, one of the two principal foreign rivals of the International organization. This will leave only the German Siemans & Halske company as a competitor for foreign telephone business outside of the General Telephone and Electric corporation, which is sponsored by the Trans-America corporation in this country.

While reports indicated that the substantial interest in the Ericsson company is to be acquired from Kreuger & Toll, which last year bought control of the Swedish telephone organization, no confirmation was available, although it is anticipated in Wall street that Ivar Kreuger will become a director of International Telephone and Telegraph corporation.

The L. M. Ericsson Telephone company has important manufacturing interests in Sweden and several foreign countries and controls telephone companies in other nations. Of prime importance to International is the Ericsson owned telephone system in Mexico which, though a competitor of International in that country, has arranged interconnections of service with the American group.

GOOD BUSINESS FROM U. S. SIGNAL CORPS

The Sands Electric company, North Chicago, Ill., reports good business from the U. S. Signal corps, having just shipped to them 200 verticals of main frames equipped with terminal strips, 10,000 pairs of heat coil protectors, and 1,000 unprotected terminals as well as considerable other equipment.

FOR SALE

Magneto Telephones, all makes. also parts for all makes. Also Leich late type Ringing interrupter, battery charging complete. Make offer in small or large quantities.

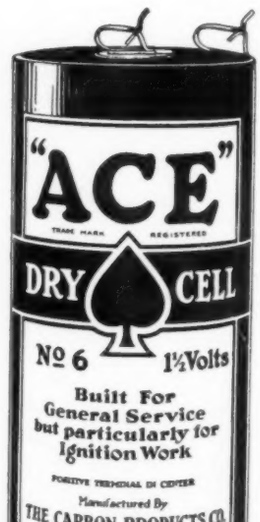
SCOTIA TELEPHONE CO.
St. Louis, Missouri

INDIANA ASSOCIATION MEETS

The Northern Indiana Telephone association held its fall meeting September 2 and 3 at the Colonial Hotel, Lake Manitou, near Rochester, Ind.

Included on the program were the following addresses: "Telephony As a Vocation," by Frank E. Bohn, president of the Fort Wayne Home Telephone and Telegraph company; "Comparative Costs of Various Classes of Service," by C. A. Kraege of the Associated Company of Elkhart; and "New Methods and Classes of Line Construction," by Frank Baker of Fort Wayne.

Outstanding Performance



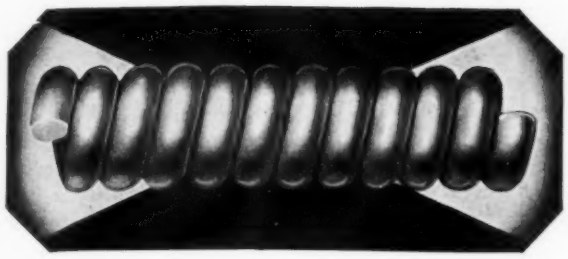
Precision in their manufacture makes Ace and Victor most uniform.

This uniformity, plus the high standard of their ingredients and laboratory control, assure greater Dry Cell Dependability and longer Dry Cell Life.

Specify Them Always

Bond Electric Corp.
JERSEY CITY

Chicago Lancaster San Francisco



Galvanized Telephone Wire and Steel Strand

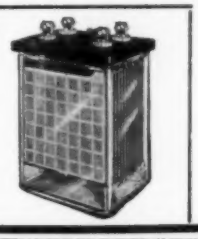
Crapo Galvanized Wire can be wrapped around its own diameter without injury to its pure zinc coating....That is one of a number of reasons why **Crapo** Galvanized Telephone Wire and Strand can be depended upon to reduce maintenance cost.

Look for the **Crapo** Seal!

Indiana Steel & Wire Co.
Muncie, Indiana

INDIANA STEEL & WIRE CO. Crapo Galvanized MUNCIE, IND.

Crapo
GALVANIZED PRODUCTS



For Every Job

Dependable battery operation is imperative to uninterrupted telephone service.

Exides are dependable. Thirty-five years of service in the telephone industry have proven that. Dependable Exides assure a long life of satisfactory service.

DEPENDABLE EXIDE BATTERIES

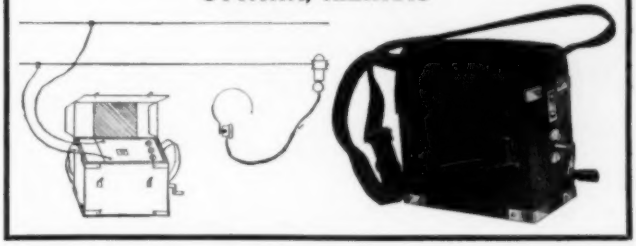
Exide BATTERIES

The Electric Storage Battery Company
Philadelphia Penna.

"STEWART" Test Set

Trade in your old test set on a New STEWART with Detector coil. Tells distance and direction to line trouble. Complete as shown in sketch for $36.00. Sent on trial. Write for literature.

STEWART BROTHERS
OTTAWA, ILLINOIS



YOU CANNOT LOSE

Most every telephone man knows about the Coffey System-Central Accounting Department—many have been using it for years. If you don't know how it can save you money and place your accounting second to none, write today for particulars.

Heretofore, the drawback to the smaller Company was the expense of getting started, but we have now arranged to handle this without expense to you, and your charge begins only after we have actually turned out your first month's statement. If at the end of the first year you are not satisfied, all records are returned in an up-to-date condition.

The Chairman of the Indiana Public Service Commission said, "It would seem to me that you have not made your Central Accounting scheme plain, or the building you are in would not be large enough to handle the business."

It costs you nothing for full particulars and it will be our pleasure to furnish them.

COFFEY SYSTEM & AUDIT CO.
Consolidated Bldg.
Indianapolis Indiana

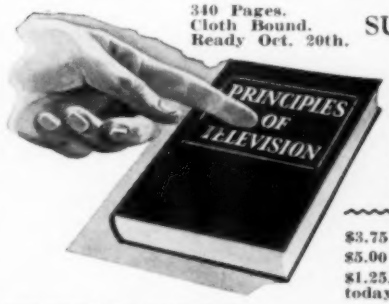
YOUR FUTURE DEPENDS ON TELEVISION

YOU want this book!

TELEVISION EXPLAINED...*fully*

...*by The Inventor Himself*

All of your engineering problems answered. "PRINCIPLES OF TELEVISION", by Farnsworth and Halloran, is the engineer's guide to all television engineering. A complete course of instruction in Television . . . all in one volume.



340 Pages.
Cloth Bound.
Ready Oct. 20th.

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Those who order now will receive a 6 month supplement service without extra cost. This keeps the book up to date.

$3.75 if you order now. $5.00 if you wait. Save $1.25. Send coupon today.

TELEPHONE ENGINEER
185 N. Wabash Ave., Chicago, Ill.

Here is $3.75 for 1 copy of "PRINCIPLES OF TELEVISION" and the 6 months' supplement service.

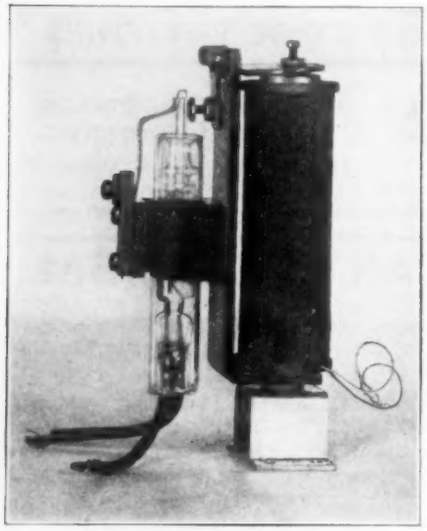
Name .....

Address .....

With Manufacturers and Jobbers

NOVEL VACUUM CONTACT CONTROLS CURRENT

Unleashing two horsepower of energy when its stem is imperceptibly moved, the vacuum contact now introduced to the electrical and allied industries of America may be termed an electrical hair trigger. In potential applications it may be likened to the vacuum tube amplifier, since it places a small amount of energy in complete control of many times as much energy. Furthermore, it eliminates most of the complicated, cumbersome array of apparatus heretofore required some, costly and frequently troublesome for the harnessing of electrical equipment to be controlled by delicate means. Properly applied, especially in conjunction with simplified light-sensitive cells, this device opens up startling possibilities.



Burgess vacuum contact for controlling considerable wattage with minimum of energy.

The Burgess Vacuum contact is a new and improved device for use wherever a positive, rapid and durable electrical contact is needed in circuits handling up to 6 amperes continuous load or 8 amperes intermittently, at potentials up to 220 volts. It can be operated by hand, by mechanical means, or again by electromagnetic agency in conjunction with the usual telephone type relay. This contact is especially well adapted for use in telegraph and telephone circuits, for railway switches and signals, for fire and burgler alarm systems, controllers, advertising signs, rectifiers, electric ranges and other applications where a considerable wattage must be controlled by a minimum of energy.

The vacuum contact is a development of Siemens & Halske of Germany and has met with wide application in that country as well as in Great Britain. It is now being introduced in the United States for the first time by the Burgess Battery company of New York and Chicago.

Operating in a vacuum, the vacuum contact is free from serious arcing and corroded contacts. It can handle its rated current as fast as 40 breaks per second. The make and break are positive and clean. The vacuum contact requires a movement of only 0.02 inch at the end of its stem, which can be brought about by a force of less than 10 ounces, and usually but 6 ounces. The temperature rise at the rated current is extremely slight. The circuit is broken without arcing at less than 0.001 inch separation of the contact blocks. The small movement and slight force required for operation lowers the total cost by the elimination of mechanical links. As for life, one of these contacts has been operated, at a rate of 10 times per second, 124,000,000 times, without breakdown.

The Burgess vacuum contact is conservatively rated to handle 6 amperes at 220 volts, or 1,320 watts, on continuous load. It will handle 8 amperes intermittently. The energy controlled is therefore of the order of two horsepower, controlled by the slightest pressure on the glass stem. There is no spark or arc, although on inductive loads a condenser is shunted across the contact. This device represents an ideal means of breaking heavy A. C. or D. C. currents with safety, rapidity and small force.

NEW NAME FOR WELL-KNOWN CORD COMPANY

Almost simultaneous with the 27th anniversary of the Runzel-Lenz Electric Manufacturing company of Chicago, an organization well known to telephone men throughout the country, came the announcement of a change in the name of the concern which will from now on be known as the Lenz Electric Manufacturing company.

J. M. Lenz, one of the founders of the original company, is president and treasurer of the new organization; H. F. Racine, who has been actively identified with the company for more than 25 years, has been elected secretary; and Philip C. Lenz, with the company for more than ten years, is now vice-president.

There will be no change in the products or business policies of the concern. The company occupies a modern four-story building, at 1751-7 North Western avenue, Chicago, equipped with the most modern machinery for the production of telephone cords, wire, and cables.

Modern plant of Lenz Electric Manufacturing Company in Chicago, formerly known as the Runzel-Lenz Mfg. Co.

BOOKLET LISTS CITIES USING CREOSOTED PINE POLES

The International Creosoting and Construction company, with headquarters at Galveston, Tex., has just issued a sixteen-page booklet listing cities in the United States where creosoted pine poles are used in business and residential sections.

Among the many hundreds of cities named are New York, Chicago, Detroit, Los Angeles, St. Louis, Baltimore, Boston, and San Francisco.

Part of the introduction to the booklet reads as follows:

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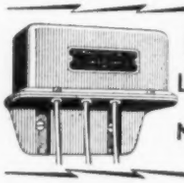

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